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CONTROL OF SOUTHERN PINE BEETLE IN WILDERNESS AREAS

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OVERSIGHT HEARING

BEFORE THE

SUBCOMMITTEE ON PUBLIC LANDS

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS HOUSE OF REPRESENTATIVES

NINETY-NINTH CONGRESS

SECOND SESSION

ON

CONTROL OF SOUTHERN PINE BEETLE IN WILDERNESS AREAS

HEARING HELD IN WASHINGTON, DC
MARCH 18, 1986

Serial No. 99-22

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CONTROL OF SOUTHERN PINE BEETLE IN WILDERNESS AREAS

TUESDAY, MARCH 18, 1986

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON PUBLIC LANDS,
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, DC.

The subcommittee met, pursuant to call, at 10 a.m., in room 1324, Longworth House Office Building, Hon. John F. Seiberling (chairman of the subcommittee) presiding.

Mr. SEIBERLING. The Subcommittee on Public Lands will come to order, please.

I thank the members of the subcommittee and our colleagues from Texas, the Forest Service, and the panels of distinguished scientists for coming here today to review the scientific issues related to control of southern pine beetle in the Southeastern wilderness areas.

The purpose of today's hearing is to, first, examine the scientific support for various beetle control methodologies; and, second, to explore the need for, and appropriateness of, controlling beetle populations in wilderness areas. The Forest Service will first explain the scientific basis for their policy of harvesting trees in and around wilderness areas in the South in order to control the southern pine beetle. The scientists who are with us today will also examine the scientific basis for this policy and the need for additional research.

While we are concerned about beetle management in all wilderness areas, much controversy has focused on five small wilderness areas created in east Texas in September 1984. When these small wilderness areas were created, Congress and the public reasonably expected that the protections heretofore extended to more than 80 million other acres of wilderness in the United States would apply to these little islands as well. The protections stem from the Wilderness Act of 1964.

Nevertheless, the Forest Service has systematically cut infested trees inside and outside of the wilderness areas, including accumulated buffer cuts as large as 68 to 100 acres. The agency has harvested approximately 40 percent of the 8,600-acre Kisatchie Hills Wilderness Area in Louisiana. Cuts in the five Texas areas are smaller, but are nevertheless substantial.

In defending its policy, the Forest Service cites a single clause in the Wilderness Act permitting the management agency to take, and I quote, "such measures . . . as may be necessary in control of

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fire, insects and disease . . ." The operative word here is "necessary," with the agency saying that it must cut virtually anywhere within the wilderness areas to prevent the spread of the beetle to nearby private lands.

Others interpret a "necessary" action as one that has been proven to be effective. And that is where much of the controversy over cutting in wilderness lies. Many scientists maintain that the scientific effectiveness of the harvesting techniques used to control beetle spots has not been proven. If they are correct, then harvesting—or certainly the current level of harvesting—should not be practices in wilderness areas.

I am advised the Forest Service publications state that cutting down individual infested spots does not contribute to areawide control of beetle populations.

The Forest Service has stated that the agency cuts within wilderness to protect adjacent private lands from beetle infestation. Yet, I have seen some maps that indicate that there are equal numbers of beetle infestations within and outside wilderness areas. Where is the scientific evidence that beetles had come out of the wilderness?

I am also advised that, by contrast, under the National Park Service management plan for the southern pine beetle in the Big Thicket National Preserve, just south of the east Texas wilderness areas, the Park Service only harvests trees with pine beetles within ¼ mile of the preserve boundary, and only if there are pine trees outside the preserve at that boundary. In addition, that agency does not cut green, noninfested trees around infested spots. I have been told that they are having success with their technique.

Predictably, the controversy surround the Forest Service program has found its way into the Federal court system. Last year the Sierra Club brought two lawsuits seeking to enjoin the agency from further cutting. In Texas, Judge William Steger denied the injunction, but told the Forest Service to follow their own guidelines and make only minimal cuts when necessary to protect threatened red cockaded woodpecker colonies or to prevent the spread of beetles to private land.

In a second case, Judge Gerhard Gesell granted an injunction against cutting in wilderness areas in Mississippi, Arkansas, and Louisiana until an environmental impact statement for control of southern pine beetle is completed.

The time has come, it seems to me, to try to proceed from rhetoric to facts. That is the purpose of this hearing—to get some scientific testimony on the population dynamics of the southern pine beetle. It is also an opportunity for the Forest Service, as author of the current cutting policy, to present whatever scientific basis exists to indicate that its heavy reliance on cutting both "necessary" and effective.

I would now be happy to recognize any other members for any opening remarks.

Mr. Sunia.

Mr. SUNIA. I have no opening remarks, Mr. Chairman.

Mr. SEIBERLING. Mr. Strang.

Mr. STRANG. Mr. Seiberling, I would like to congratulate the chairman on raising this issue and having this hearing. I think it is important because we have similar situations throughout the West

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with infestations in particularly pines and other conifers in wilderness areas and outside of wilderness areas.

I do hope that out of this hearing will come some beneficial comment and advice. Particularly I would hope that we can get some good testimony on experience with controlling these kinds of infestations, because I gather there is very little.

I wish you well on your list of witnesses. That is all I have, Mr. Chairman.

Mr. SEIBERLING. Thank you.

Our first witness today is the Honorable Joe Barton, a member of this committee, representing the Sixth District of Texas. It is a pleasure to have him here to testify on this important issue.

[Prepared statement of Hon. Joe Barton may be found in the appendix.]

STATEMENT OF HON. JOE BARTON, A U.S. REPRESENTATIVE FROM THE STATE OF TEXAS

Mr. BARTON. Thank you, Mr. Chairman. I would like to commend you for holding this hearing. This is an issue that, while it may not loom large in the overall efforts before us in this Congress, for those groups and people who are concerned about environmental issues and the use of our forest lands, it is a very controversial and complicated issue, and I commend you for holding this hearing.

I am grateful for the opportunity to testify on the impact of the southern pine beetle on wilderness areas areas in Texas. As you may know, Montgomery County in my congressional district is one of the areas most heavily devastated by the pine beetle. The Little Lake Creek wilderness area in the Sam Houston National Forests also lies within my congressional district, so I have an abiding interest in the fight against the beetle on Federal lands.

Congressman Charles Wilson also has a large number of forest lands in his district that have been infested by the southern pine beetle.

The southern pine beetle has been recognized for many years as the most destructive insect pest in southern pine forests. In 1985, 15,777 pine beetle infestations were detected in Texas alone. That year, the beetle destroyed an estimated 472 million board-feet of timber, enough to build 47,200 homes. The standing value of this timber is estimated to be worth nearly $61 million.

Research demonstrates that the pine beetle prefers to attack older pines growing in crowded conditions, such as populate the national forests in Texas. Although the Texas national forests comprise only 6 percent of the commercial forest land in the State, they sustained nearly 30 percent of the timber killed by the pine beetle in 1985. I am concerned that the national forests could become a breeding ground for the beetle and that they could spread to private lands that border the forests. Obviously, some of my constituents share this concern.

Mr. Chairman, I would like to point out that in the wilderness areas that have been set up in my congressional district, they are very small wilderness areas, which I think you alluded to in your opening statement. So it is very easy for the pine beetle to spread from the public lands into the private lands.

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It is my understanding that the subcommittee is interested in determining how best we can combat the beetle in wilderness areas. As you know, the Texas Forest Service believe that the best way to combat the beetle is through selective cut-and-leave and cut-and-clear operations. Others believe that we should allow the beetle infestations, also known as spots, to die out by themselves. Opponents of cutting cite evidence that cutting is not effective in all cases, while the Texas Forest Service cites instances where inaction allowed infestations to spread unimpeded across hundreds or even thousands of acres. According to the Texas Forest Service, about 5,000 acres of timber in the Big Thicket National Preserve were destroyed by the pine beetle last year when cutting did not take place. A similar event occurred in the Beech Creek unit of the Big Thicket National Preserve in 1976.

It appears that direct control methods such as cutting may not be appropriate in all instances. According to the Texas Forest Service, 30 to 50 percent of all spots become inactive without any application of direct control methods. The infestations that tend to die out by themselves are the smaller spots that contain less than 50 trees. I understand that the Forest Service monitors beetle spots in order to determine whether they surpass the 30-tree threshold, and that they generally base their decision on whether or not to cut on the size of the beetle infestation. Direct control methods should be focused on large southern pine beetle infestations.

The Texas Forest Service has also broken ground on pheromones research. Pheromones are beetle-produced odors that control beetle aggregation and other behavior in order to prevent the beetle from destroying pine forests in Texas and other States. Pheromones can be used to concentrate beetle populations on resistant or dead trees and decimate the beetles. They can also lure beetles to trees that have had chemical treatment. Other pheromones can disrupt pine beetles and repel them from pines that are under attack.

Much of this pheromones research has taken place at Texas A&M University, which is located in my district. Pheromones promises to be an effective way to combat the southern pine beetle without disturbing the national forests. I hope that funding for pheromones research can be increased so we can develop this promising alternative sooner. I plan to request that the Appropriations Committee increase the funding for southern pine beetle research.

Mr. Chairman, as you know, since you and I serve on this committee, I am not a scientist. I cannot say that I know the answer to the menace posed by the southern pine beetle. However, I must say that I believe that the Texas Forest Service has done a good job fighting the beetle over the years, and I am proud of their efforts. I hope that the testimony of the other witnesses will shed some light on this dire problem, and that they will be able to offer some constructive comments on how we in Texas can improve our efforts to combat the beetle. The southern pine beetle is one creature that I would like to see become endangered, at least in Texas.

As you can see from the attached map, the southern pine beetle threatens 21 States in the United States, including your home State of Ohio. I hope the chairman and the subcommittee will support additional funding for research into the southern pine beetle.

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Thank you for the opportunity to testify before you on something that is important to my constituents. I hope that we can work together to develop the best control strategy to combat the southern pine beetle.

Mr. Chairman, after the questions, I would like the opportunity to come to the other side of the podium and participate with you in the rest of the hearing, if that is permissible.

Mr. SEIBERLING. Yes, you are certainly welcome to do so, and we are happy to have your participation.

I have no questions.

Mr. Strang? Mr. Sunia?

Thank you very much.

We will now proceed with Mr. Douglas MacCleery, Deputy Assistant Secretary, Natural Resources and Environment, U.S. Department of Agriculture, accompanied by Mr. Dale Robertson, Associate Chief, Forest Service, U.S. Department of Agriculture; and Dr. Ronald Billings, principal entomologist of the Texas State Forest Service.

All right, sir, it is good to see you.

[Prepared statements of Hon. Douglas MacCleery and Ronald Billings, with attachment, may be found in the appendix.]

STATEMENTS OF DOUGLAS W. MacCLEERY, DEPUTY ASSISTANT SECRETARY, NATURAL RESOURCES AND ENVIRONMENT, U.S. DEPARTMENT OF AGRICULTURE, ACCOMPANIED BY DALE ROBERTSON, ASSOCIATE CHIEF, FOREST SERVICE; DAVID DAILY, DEPUTY FOREST SUPERVISOR, NATIONAL FORESTS IN TEXAS; AND RONALD BILLINGS, PRINCIPAL ENTOMOLOGIST, TEXAS FOREST SERVICE

Mr. MACCLEERY. It is good to be here, Mr. Chairman.

We do appreciate the opportunity to join the subcommittee in this oversight hearing on efforts to control the southern pine beetle. I have with me today to my left, Mr. Dale Robertson, Associate Chief of the Forest Service; to my right is David Dailey, Deputy Forest Supervisor, National Forests in Texas; and to Mr. Robertson's left is Dr. Ronald Billings, principal entomologist for the Texas Forest Service, Lufkin, TX.

We also have a distinguished number of people behind us. Dr. Robert C. Thatcher, assistant director of the Southeastern Forest Experiment Station, Asheville, NC, is with us. Dr. Thatcher is responsible for research on southern pine beetle southwide.

Also, Dr. Michael Lennartz, our research biologist project leader at the Southeast Forest Experiment Station, Clemson, SC, is here. Dr. Lennartz is responsible for research efforts related to the red cockaded woodpecker.

And also we have Mr. Ken Swain, Chief Entomologist, Forest Pest Management, in the Forest Service's Region 8.

I would like to provide an overview of the southern pine beetle problem in the Southeast, and describe our control program, particularly in connection with wilderness areas, and the status of litigation involving the control program. Dr. Billings will provide the subcommittee information on the scientific basis for the beetle control efforts now underway.

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The Department of Agriculture is concerned about the potential for extensive damage posed by the current outbreak of southern pine beetle in Texas and other Southern States. The southern pine beetle is a native pest, indigenous to the pine forests from Texas to Virginia. Outbreaks of this insect have occurred throughout history at irregular 10-year intervals, initially triggered by stress in the forests related to droughts, severe storm damage or overdense and aging forest stands. Outbreaks may last from 3 to 5 years and cause severe losses to forest resources.

The South-wide outbreak from 1971 to 1976 resulted in the loss of over 6 million cords of pulpwood and over 2 billion board feet of timber. In 1976 dollars, this represented a loss to the Southern and national economies of $178 million. The current outbreak in Texas, Louisiana, and Mississippi, which began in 1982, has already killed over 1 billion board feet of timber, for a total loss of over $150 million. The outbreak is continuing across the Gulf South and into the Piedmont and coastal plain pine forests of the Atlantic Coast States.

There are no known control measures that can entirely stop a southern pine beetle outbreak of this size. Control activities employed by the Department of Agriculture, the State forestry agencies and private forest landowners in the South are intended to reduce the extent of losses until the outbreak ends.

Salvage removal of infested trees is the preferred and most effective control technique. Under this procedure, the beetle-infested trees are taken from the forest, thereby removing an important component of the beetle population and reducing the potential for the spread of the epidemic. In recent years, cutting and leaving the infested trees in the forest has been used in situations where salvage was not practical.

Although the latter technique does not physically remove the beetles from the forest, our data indicate that significantly greater than normal beetle mortality occurs after beetle emergence from the trees. Surviving beetles are also less likely to successfully attack nearby healthy trees. This is attributed to the disruption that felling the trees causes in beetle behavior that is required for mass attacks on living pine trees. Chemical control may also be used under certain circumstances where the economics of treatment justify the additional expense. This usually amounts to a hand spraying of insecticide to the boles of felled infested trees to kill beetles as they emerge.

A major issue associated with the southern pine beetle outbreak is the concern that the beetle infestations in wilderness areas may escape and cause unacceptable damage to resource values on adjacent public and private lands. The southern pine beetle outbreaks occur in 9 of the 60 wilderness areas in the South. Control activities have been conducted by the Forest Service in five wilderness areas in Texas, and one each in Louisiana, Arkansas, and Mississippi. A wilderness area in Alabama has recently been infested by southern pine beetles, but no control has been taken.

Southern pine beetle control in the wilderness areas is within the Secretary of Agriculture's discretionary authority created by the Wilderness Act, which permits measures to be taken to control fire, insects, and diseases, subject to such conditions as the Secre-

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tary deems desirable. When it is necessary to take control actions in wilderness areas, we try to do it with the least impact to wilderness values. Southern pine beetle control in wilderness areas is undertaken for two purposes: to protect forest resources outside of and adjacent to the wilderness areas when these resources are being threatened by beetles that originate in the wilderness areas; and to protect the habitat of the endangered red cockaded woodpecker colonies within and outside the wilderness areas.

The Forest Service is currently in litigation over its southern pine beetle control activities in wilderness areas. The District of Columbia district court issued a preliminary injunction restricting control activities in Louisiana, Arkansas, and Mississippi wilderness areas to those necessary for protecting red cockaded woodpecker colonies. The Forest Service is now preparing a new environmental impact statement on southern pine beetle control, with particular emphasis on control activities within the wilderness areas. A draft statement is expected to be available for public comment by July 1 of this year.

The southern pine beetle is an extremely destructive pest. Over the years, a control strategy for general forest areas has emerged that calls for the early detection, evaluation, and prompt treatment of spot infestations. The key to success is treatment of spot infestations before the end of the life cycle to prevent the beetle from emerging, reproducing and spreading to surrounding areas. This strategy is employed when the southern pine beetle is determined to be a potential threat to valuable forest resources outside wilderness or to red cockaded woodpecker colonies within our outside of wilderness areas.

Unfortunately, the Forest Service is placed in the position of making a difficult judgment on control of southern pine beetle in wilderness areas. On the one hand, we believe that action should be taken to control the spread of the beetle so as to protect the endangered red cockaded woodpecker colonies and reduce the potential damages to forest resources outside the wilderness. On the other hand, the agency has an obligation and commitment to protect wilderness values and to allow natural processes to run their course within the wilderness areas. The wilderness areas in the South are comparatively small and interspersed with pine forest land, both National Forest private. If we are to be effective in controlling the beetle, we must treat infested areas in wilderness which are likely to build and spread to surrounding land. We realize that this adversely affects wilderness values, but we have to make the difficult judgment of when the threat and potential damage will be so great that prudence requires control within the wilderness areas.

The environmental impact statement being prepared by the Forest Service for the southwide southern pine beetle control program will examine this issue thoroughly. Until the EIS is available, the Forest Service will continue to follow the court orders governing control activities in Texas and other Southern wilderness areas.

Mr. Chairman, that concludes my statement. I would like to turn it over to Dr. Billings for his statement, and then we would be happy to answer any questions that you might have.

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Mr. SEIBERLING. All right. It is unusual to have the Forest Service bring in someone from outside the Service to report their position, but we certainly have no objection to that. We would be happy to hear from Dr. Billings.

Mr. BILLINGS. Mr. Chairman and members of the committee, the purpose of my statement is to present scientific justification and expert testimony on behalf of the U.S. Forest Service to support continued efforts within the National Forests in Texas, including certain wilderness areas, to control infestations of the southern pine beetle.

I also appreciate the opportunity to express the concern of private landowners in eastern Texas, as well as the State Forest Service in Texas, on the potential policy of no control in these wilderness areas.

Since 1973, I have held the position of principal entomologist with the Texas Forest Service in Lufkin. As head of this agency's Forest Pest Control Section, I am responsible for developing and administrating programs of forest pest survey and control, particularly southern pine beetle detection and control, on all non-Federal lands in Texas. I wear two hats, however. I am also involved in research, primarily research on southern pine beetle. In the past, this has involved the evaluation of the efficacy of control tactics used in Texas on an areawide basis. Currently I am involved in developing synthetic pheromones for potential control of southern pine beetle infestations in cooperation with Dr. Thomas L. Payne at Texas A&M University.

I have published numerous scientific articles and instructional handbooks on southern pine beetle detection, evaluation, suppression and prevention, and have published basic research papers on southern pine beetle behavior and host selection. These publications include two USDA agricultural handbooks on southern pine beetle detection and ground evaluation, as well as a chapter in technical bulletin 1631 that summarizes our knowledge of southern pine beetle. This chapter was on the current state of the art on direct control.

I have maintained close contact with the USDA Forest Service in Texas and have maintained an interest in the management of the National Forests, including wilderness areas. I have also provided background information for the 1986 environmental impact statement on southern pine beetle suppression.

Much of the beetle control work in eastern Texas in the last 25 years has occurred on private and industrial lands, and only more recently on National Forest System lands. The Texas Forest Service, therefore, has considerable experience in designing, carrying out, and evaluating the current direct control tactics used for southern pine beetle infestation suppression.

In order to understand southern pine beetle control tactics or infestation control tactics as they are currently applied, you need a basic understanding of the biology and seasonal behavior of the southern pine beetle, as we understand it in east Texas. Although my experience is limited to eastern Texas, I think the same relationships hold throughout the Gulf Coastal States of the South.

The southern pine beetle is the major pest of mature southern pine forests, and the destructive potential of this beetle is attrib-

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uted to its very rapid life cycle. It can grow from an egg to an adult beetle in just 36 days, completing up to seven life cycles in 1 year. Following the attack on one tree, females may emerge to attack a second tree. In each tree, the famale beetle deposits up to 30 eggs. These eggs develop very rapidly and, within 60 days, the beetles that developed from these eggs are grandparents. It happens that fast in warm weather.

The other destructive potential of the southern pine beetle can be attributed to its ability to successfully aggregate and concentrate in multiple tree infestations. By so doing it can overcome the resistance of even healthy pine trees. Pine trees of all ages beyond 5 years of age are susceptible to being killed by southern pine beetle in these expanding multiple-tree infestations.

Historical records that we have maintained in Texas for the last 20 years show a very typical seasonal pattern. Most of our large expanding infestations in eastern Texas, the ones that are candidates for control, are initiated during the spring months of March, April and May. These usually get started in weakened stands, those stressed by overcrowding, age, flooding and drought. The initial tree may be weakened even further by lightning.

In this way, the beetles get a foothold in a tree that cannot defend itself. Once the female enters the bark, it puts out a powerful attractant or pheromone. This pheromone is the key to what happens later in the development of that infestation. The pheromone combines with the odor of the resin of the tree and becomes very attractive to other beetles flying in the area. Beetles are induced to join the females in the attack. Beetles attacking en masse overcome the defense mechanism of that weakened tree and, if there are enough beetles in the area, they spread to adjacent trees. These are some of the same pheromones that are currently being used under experimental conditions for a potential control use.

Again, if the female is successful in calling in enough beetles to overcome the tree's defenses and colonize the tree, she lays eggs. Those eggs develop under the bark, and girdle the tree. Also, a blue-stain fungus is brought in by the beetles. Between the blue-stain fungus, which blocks the water-conducting tissues of the tree, and the girdling action of the adult beetles, the tree may be dead within 3 days. The beetles may then spread, in response to the pheromones to adjacent trees within 20 to 40 feet or farther from the tree first attacked

In contrast, healthy trees have enough resin in their system, enough defenses, to kick out the initial beetle and drown it in resin before it can produce those critical pheromones. As a result, the beetles initially attacking the tree are killed. They do not call in reinforcements, that healthy tree lives, and no infestation gets started in that area. At other times, an infestation may be limited to a few trees.

It is critical to understand that infestations get started in weakened stands or weakened trees. However, the beetle is not limited to weakened trees once a large infestation develops, because the southern pine beetle has another unique mode of attack which we call spot growth. When an individual infestation becomes established and reaches the level of about 30 trees, it can self-perpetuate itself and expand in size over time. This happens when beetle

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broods complete development and emerge from initially attacked trees and respond to those attractants that I spoke about, the pheromones, on the periphery of the spot. So you get a self-perpetuating cycle of beetle development, emergence, response, and additional attacks, all within the same infestation. Once you get this process going, infestations can persist and expand throughout several generations of beetles. It is in these situations that an infestation becomes a target for control because, without control, the infestation may double in size every 30 days. Infestations can grow from a few trees to several hundred acres of forest, even several thousand acres, if no control is applied.

Admittedly, not all infestations reach this size. We are only concerned with a small proportion of the infestations that reach this critical threshold. Our records indicate that in Texas, 70 percent of our timber losses are caused by 30 percent of all spots detected, and these large expanding infestations, called hotspots cause most of the timber losses.

Even healthy, vigorous, growing pines on the edge of these expanding infestations are likely to be killed as the infestation expands, due to the high concentration of beetles in the area and the continual presence of these attack-inducing attractants or pheromones.

As a result of over 10 years of very intensive research that has been conducted from 1974 through 1985, we know much more now about beetle behavior. As a part of this research, sophisticated computer models that predict the rate of expansion of uncontrolled beetle infestations have been developed both at the University of Arkansas under the direction of Dr. Fred Steven, and at Texas A&M University under the direction of Dr. Robert Coulson.

These simulation models can be used to illustrate what will happen in a given infestation as a result of this spot growth phenomenon, or spot expansion phenomenon, if no control is applied. They vividly illustrate that, given the right stand conditions and the appropriate number of trees, infestations may double in size every 30 days. In other words, within an infestation with 100 infested trees on day 1, an additional 100 to 200 trees may be killed by beetles within 30 days if no control is applied.

These large hotspots will continue to grow, and trees will continue to be killed until either no additional pines are within close proximity to the leading edge of the spot, cool weather or other environmental factors disrupt the synchrony that is generated between beetle emergence and beetle production of pheromones on the spot periphery, or man steps in with some direct control tactics, such as cut-and-remove or cut-and-leave.

Spot initiation, or what we call spot proliferation, is the primary mode of beetle activity in the spring, and again in the fall. In contrast, during the hot summer months, beetles on the gulf coast tend to survive through this spot growth process. They fly short distances and infest trees in the immediate vicinity of the spot from which they emerge, adding to spot growth.

Apparently, very few new infestations get started during June, July, and August. It is a time when beetles limit their dispersal flights, and their survival is enhanced by staying within the same infestation in which they developed. As a result, we get our ma-

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mum spot growth and maximum timber losses during that period. Accordingly, most of our detection work centers on spring spot initiation. Most of our control is conducted during the summer months to counteract these established spring infestations.

What, then, are our direct control tactics and strategies? The principal direct control tactics currently used in Texas, both on private industrial lands, as well as Federal lands including wilderness areas, are cut-and-remove, otherwise known as salvage, and cut-and-leave.

Cut-and-remove has been shown from extensive experience, including 20 to 30 years of continuous use in Texas, to be a valid and effective means to reduce timber losses in these expanding hot-spots. Cut-and-remove does several things. It prevents further timber losses from spot growth by disrupting the process I talked about of pheromone induced attack on the periphery of infestations. The size of the resident beetle population within an infestation is reduced when beetle-infested trees are removed from the forest and utilized. And for the small landowner with commercial forest timber, the economic losses are reduced when those beetle-killed trees and buffer strip trees are sold to a mill.

We prefer to use salvage on commercial forest lands because of these many benefits. Unfortunately, we found that many circumstances exist where we cannot apply salvage. As a result, due to a need to try to treat and reduce losses in these areas where we cannot provide salvage, the Texas Forest Service has long used a method known as cut-and-leave. Cut-and-leave is a method developed out of necessity. It is a simple, practical, cost-effective method for doing essentially the same thing as salvage as far as disrupting potential spot growth.

The method consists of falling all beetle infested trees in toward the center of the infestation, and also falling a buffer strip of uninfested trees, usually about 40 to 60 feet wide, around the periphery of the leading edge of the infestation. The purpose of this treatment is to disrupt the flow of attractants and spot expansion that is the primary mode of beetle attack and beetle survival during the summer months.

Again, cut-and-leave is recommended primarily for use between May and October for the specific purpose of disrupting spot growth. This is the season when we can take advantage of a limitation in the beetle's life cycle, causing them to disperse out of active infestations at a time when they normally do not do that. They normally cannot survive for long periods outside of expanding infestations. Very few new spots are being initiated. We are trying to reduce the beetles' capacity to survive and to take advantage of their behavioral shortcomings by forcing the beetle out of those concentrated population centers during the unfavorable summer season.

Once a felled tree that is attacked by beetles is put in a horizontal position, it rapidly loses its attractancy for the southern pine beetles. Beetles only attack vertical objects. Once a tree is severed and put in a horizontal position on the ground, it no longer draws in other beetles and no longer presents a contagious threat to neighboring pines, particularly when a buffer strip of 40 to 60 feet is added to that treatment to eliminate any potential hosts within the pheromone influence.

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What happens to the beetles from these emerging spots? This is an area that I think definitely deserves more research. However, we have empirical evidence that suggests that when we apply cut-and-leave or salvage during the summer months, we are not aggravating the problem by creating many new spots around these treated spots. We looked at this possibility through sequential aerial photographs back in the midseventies. We also did an areawide computer evaluation of the frequency of new infestations following control treatment with both cut-and-leave and salvage on private and industrial lands, where extensive use of cut-and-leave and cut-and-remove was used.

What we found is that you are more likely to develop a new spot infestation around an uncontrolled spot than you are around a spot that is disrupted by cut-and-leave or cut-and-remove. That is the very reason that those uncontrolled spots are liable to persist and maintain a beetle population into the fall, when the beetles then can successfully leave and start up a new spot in adjacent areas. If we disrupt those expanding spots during the heat of the summer, forcing the beetles out at that hostile period, we prevent further spot growth and get very few new spots showing up as a direct result of a control treatment.

So, based on this empirical evidence, we are satisfied that in Texas, on State and private lands, we can successfully manage beetle infestations and minimize summer losses, when they are usually greatest, by applying judicious cut-and-leave or salvage to large, expanding infestations.

How effective are these direct control tactics? There is often confusion as to what we mean by effectiveness. In my opinion, a direct control tactic is effective under operational conditions if it is simple, practical and economical to apply is successful in bringing about the desired effect in the majority of the situations under which it is applied, and causes no undue, undesirable or long-lasting side effects.

Based on these criteria, I consider both cut-and-remove and cut-and-leave to be effective if applied in a timely manner for southern pine beetle infestation control.

It is important to realize that we are not striving for, nor do we expect, total population control by these methods. We are attempting to minimize timber losses within individual expanding infestations of the southern pine beetle.

Also, we know from experience that the level of effectiveness will vary with the season of the year, with how soon we get in to treat an infestation, and many other factors. But until more research is done and a better approach can be developed and extensively field tested under operational conditions, these tactics offer the best alternatives available to cope with destructive southern pine beetle infestations, both within wilderness areas and on commercial forest lands.

By treating expanding infestations in early stages of spot development, experience has shown that we are 70- to 90-percent effective with a single treatment. The remainder of the treated spots usually are effectively controlled and the spot growth process is disrupted with a second treatment.

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Also, by forcing beetles out of these expanding spots in midsummer periods, those treated spots are rendered inactive before the fall period when beetles normally are able to start new spots. So we gain by minimizing losses of spot growth and reducing eventual new spot proliferation by timely spot disruption control tactics.

Again, I would like to emphasize that we are not striving for beetle population control on an areawide basis. We have learned that it is not possible to eradicate the beetle, nor, probably, desirable. It is probably not possible to drastically change the course of outbreaks in terms of the total number of infestations that develop in a given year. It is much like fighting forest fires. We can have very effective forest fire fighting techniques that put a fire out, but that does not guarantee that we are not going to have fires the next day or the next season. When those forest fires occur, we can apply those tactics again, and effectively reduce our damages. There is a similar relationship with areawide beetle infestation episodes.

Besides, in the case of southern pine beetle, we are not treating all spots, either inside of the wilderness, or outside wilderness. We are only treating those active infestations that reach a certain threshold of size and threaten commercial forest lands.

Cut-and-leave has been used since 1970 instead of insecticide control on spots in Texas that were not salvageable. From the period 1973 to 1983, we applied cut-and-leave on non-Federal lands to 7,326 infestations, and we have applied salvage, or cut-and-remove, to 9,862. So I believe that the methods are proven. They have been field tested extensively under operational conditions, and we are satisfied that they meet our goals for infestation control.

These methods do have their drawbacks, and I think these need to be mentioned, because there is a need for further research.

Even cut-and-leave is objectionable to certain individuals, because the buffer strip of green trees are sacrificed. Trees have to be felled in the first place. Ideally, if we had a control, such as pheromone control, that we could apply to standing trees, and disrupt beetle behavior without having to sacrifice the living trees on the periphery of these infestations, I think we would have an improved control technique.

But with the current methods that we have, we are satisfied that they meet our needs. In fact, in the midseventies, we asked ourselves many of the same questions that are now being asked of the U.S. Forest Service: In particular, are we aggravating these problems by applying cut-and-leave?

We used sequential aerial photographs to show that one landowner who applied prompt cut-and-leave and salvage was able to reduce his losses by 85 percent compared with another large industrial landowner, who took very late, delayed control on their infestations.

We also have much historical experience on what happens when you do not control beetle infestations, particularly in Texas. Some of the largest infestations that we have suffered in Texas in the last 20 years have occurred on preserve areas or areas that have been set aside, where control is either delayed, was never applied or was prematurely discontinued.

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We can take, for example, the Beech Creek and Lance Rosier units of the Big Thicket National Preserve in 1976, which had large infestations amounting to several thousand acres as a result of prematurely discontinued controls as those areas were being purchased for the Big Thicket National Preserve.

Just this past year, an additional 5,000 acres on the Big Sandy unit of the Big Thicket was killed by beetles, following a no control policy by the National Park Service. The only reason these infestations did not impact private lands adjacent as much as they could have is that most of the private lands adjacent to the Big Sandy unit are in the hands of industry, and these forests have been clearcut in the last few years. Very young, 1- to 2-year-old pine plantations are not susceptible to the southern pine beetle. So, this time around, adjacent landowners saw the writing on the wall and were able to time their harvest to escape losses from the tremendous beetle populations that developed in the Big Sandy unit. Unfortunately, the same situation does not exist currently with regard to the wilderness areas in Texas.

I will now give the main reason why I believe we should control southern pine beetle infestations in the wilderness areas and why I believe the Forest Service is continuing to apply judicious control to certain infestations within wilderness.

We have learned from many years of practical experience that the control tactics that we presently have, cut-and-remove and cut-and-leave, are most effective when applied very early in the development of an individual infestation. Ideally, we would try to apply those controls before the infestation reaches 100 trees in size. The bigger the infestation is allowed to develop before control is applied, the more difficult it is to bring about control using these methods.

Most of the wilderness areas in Texas are very vulnerable to initiation of beetle infestations, as well as the development of these hotspots. Most of the wilderness areas are quite small, ranging from 3,000 acres to the largest one at 12,000 acres. Within a wilderness one is never far from a wilderness area boundary. There is no place where an infestation could develop in a wilderness area that could not conceivably spread to the boundary within one season.

The Texas Forest Service has recently done a study to map the host conditions for the beetle, the habitat conditions in eastern Texas, to find out where southern pine beetle outbreaks are most likely to develop. We identified 32 beetle-prone grid blocks. These are tracts of land amounting to 18,000 acres each that are highly susceptible to southern pine beetle. And most of these, 84 percent of them, include National Forest System land. There is a higher probability of developing beetle outbreaks in these high-hazard areas, and most of them are centered on National Forest System lands.

Of these, the Little Lake Creek Wilderness Area, the Upland Island Wilderness Area and the Turkey Hill Wilderness Area fall within high-hazard grid blocks. So the risk of southern pine beetle is greater within these areas.

This evaluation was confirmed by the outbreak in 1985. We found, by looking over the records that grid blocks or 18,000 acre units, in Texas that contain wilderness had twice as many infesta-

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tions on both Federal lands and private lands than adjacent grid blocks that were void of wilderness. And these grid blocks with wilderness had four times as many infestations as grid blocks containing only privately owned forest land.

So the message, I think, is clear. Pine stands in and around wilderness areas, regardless of ownership, have a high risk of southern pine beetle infestation. If we are going to avoid the buildup of beetle populations on these wilderness areas and the spread to private lands, we need to take the approach the National Forests in Texas are currently following; that is to use detection in these wilderness areas to locate infestations, evaluate which ones have the potential to spread, and then treat these potentially threatening infestations early in their development, even if those spots are located away from a boundary, if we are expected to protect surrounding lands.

In summary, Mr. Chairman, I would like to go through a series of photographs that illustrate what happened within the Four Notch Area, a proposed wilderness area, without control in 1983, as an excellent example of what we are talking about: an area where no control or delayed control was applied. [Photograph shown.]

This sequence of photographs was taken on the Sam Houston National Forest on the Four Notch Area, which is a 6,500-acre tract of land that was being considered in 1983 as a potential wilderness area. It was a further planning area at that time.

Beetles began developing in that area. They were first detected in August 1982, and were allowed to go without control because of the environmentally sensitive nature of the area. [Photograph shown.]

This first picture may be a little difficult to see, but it shows a single infestation of about 10 acres in April 1983 right in the center of the proposed Four Notch unit. The red-topped trees and also some green infested trees are in the early stages of infestation development. At that point in time, this infestation covered about 10 acres. This was taken in April, and the dark trees are pines. There are a few hardwoods mixed in there, but it is primarily a very susceptible stand for southern pine beetle: 80- and 90-year-old pine saw timber and overmature timber in very dense stands.

I had the opportunity to watch this infestation grow and to photograph it at 2-month intervals. [Photograph shown.]

Here we see the same infestation in June of 1983, just two months later. The infestation now has grown from 10 to over 300 acres expanding rapidly. All the green trees in the foreground actually had beetles at this time. It takes about a month for those trees to show up as dead trees from the air.

The infestation was expanding in this direction, also heading back toward a very young pine plantation. [Photograph shown.]

Again, here is an instance of infestation that started well within the boundaries of a proposed wilderness area.

Control of this infestation was delayed because of the consideration for wilderness. Also, during this period the U.S. Forest Service was preparing an environmental assessment on how to treat southern pine beetles in proposed wilderness areas. So the infestation essentially went uncontrolled for at least 2 more months. [Photograph shown.]

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Two months later, in August 1983, the infestation has now grown from 300 to 1,000 acres. It has advanced into a very young pine plantation. These trees are only 12 years old with a very small diameter. Under normal conditions, they would not be attacked by southern pine beetle. They are too young to produce much food. They are only being killed because the mass population of beetles is moving tree by tree through the area.

Mr. SEIBERLING. Is this an area of second or third growth?

Mr. BILLINGS. It is, I believe, second growth. Part of this was an early experimental forest.

Mr. SEIBERLING. Was it planted entirely in softwoods?

Mr. BILLINGS. It was planted primarily in pine. It has some hardwoods mixed in.

Mr. SEIBERLING. But the hardwoods were just inadvertent, in other words.

Mr. BILLINGS. That is correct. It was primarily heavy pine timber.

Mr. SEIBERLING. Thank you.

Mr. BILLINGS. Within 4 months, the infestation had grown from 10 to 1,000 acres. At this time, the decision was made to begin control. Unfortunately, this was far beyond the recommended size for application of cut-and-leave or salvage removal. We seldom allow spots to get that big.

The U.S. Forest Service used several different control techniques. They tried to set out with salvage sales, but these were complicated by Hurricane Alicia, which passed over the area, blocked roads, inundated the area with rain, and pretty well halted the salvage approach to control.

Mr. SEIBERLING. How far inside the wilderness area was the original spot?

Mr. BILLINGS. Mr. Daily.

Mr. DAILY. About one-quarter of a mile.

Mr. BILLINGS. A quarter mile, I think, in this direction, and probably over 1 mile in this direction.

But at this point in time, that infestation was 3½ miles around and advancing on all sides at 50 feet per day, a tremendous population and rate of growth.

Mr. BARTON. How many beetles are active out there?

Mr. BILLINGS. This part back here is old and dead. The beetles have already emerged from these trees. They will be in these so-called fading, or yellow-top, trees and all the green trees in the foreground. It is a wave of beetles that is moving out in all directions.

The control method used was to cut a buffer strip, using a modified cut-and-leave method, even though it was a very huge spot, around the infestation. This control line consisted of 125 feet of recently attacked trees. This was an effort to remove that source of pheromone that was creating this problem. The control line also included 125 feet of unattacked buffer trees. This is a wider than normal buffer recommendation, but again they were dealing with more than the average-sized infestation. [Photograph shown.]

One point that I would like to make here is that control was initiated when this infestation covered 1,000 acres, and this would be what we might be faced with in wilderness areas. By the time this

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single infestation was finally controlled, it covered 3,500 acres, so it tripled in size before it was successfully brought under control. This was due to the tremendous population of beetles that were allowed to develop in that 6-month period. [Photograph shown.]

This is a closeup of the buffer strip in the young plantation. You can see that practically every tree is being killed, and a buffer is used to successfully stop further expansion in that area. [Photograph shown.]

This is at the boundary of the proposed wilderness area. By the following month, September, the infestation has spread onto commercial Forest Service land. It has also spread to private lands in the background. The landowner who was unfortunate enough to live in that area had to sell his timber. It was infested with beetles. You can also see many new infestations starting up from beetles currently generating out of this area.

Mr. SEIBERLING. What evidence is there that it generated out of that area?

Mr. BILLINGS. In 1983, when this developed, we had very few beetle populations elsewhere in the State. In fact, all of our beetle activity was centered right in this area. So there is pretty good empirical evidence that these new infestations probably generated from this large population. We have no direct evidence. We didn't tag the beetles. But we have, I think, empirical evidence, in that this is where the major population of beetles were centered in Texas during 1983.

Mr. BARTON. Was there any evidence of large beetle infestations in the other parts of the area that could have caused that?

Mr. BILLINGS. Not during that period, no. They have developed since then, in 1984 and 1985, but in 1981, we did not detect any infestations throughout Texas on National Forest System or private lands. In 1982, we had a few small infestations, and in 1983 we had this big blowup centered in that one area.

Mr. BARTON. How long can a beetle population remain active because of the climatic conditions? Could there have been some beetles in those other areas 2 or 3 years before?

Mr. BILLINGS. There is no doubt that an endemic level of beetles, a low level of beetles is present all of the time. Even when there is a low population, and we don't detect infestations, the beetles are out there. They survive in single trees mixed in with other native bark beetles, and they are very difficult to find. They create no problems, so we don't bother to look for those single-tree spots. But when you get the right host conditions, habitat conditions, and the right environmental conditions that favor reproduction, they can develop very rapidly and take advantage of those conditions where control is not used. [Photograph shown.]

This is what the same area looked like in February 1984, following salvage of the timber by helicopter. Helicopters were brought in because, at the time, the area was still being considered for wilderness, and the U.S. Forest Service wanted to minimize the amount of roads in the area. Helicopters were used to airlift timber out of the buffer strip to reduce the beetle population.

Ironically, as a result of the beetle activity and the control effort, the area was dropped from further wilderness consideration, and

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the State of Texas lost about $4 million in timber revenue as a result.

What would have happened if we had employed prompt direct control efforts in those areas? [Photograph shown.]

Here are some photographs of what a controlled spot, early in the development of a spot, looks like following salvage, or cut-and-remove treatment. There is a small opening in the stand. Hardwoods, for the most part, are left standing. The beetle-infested trees are removed The surrounding timber is protected from that constant onslaught of pheromone-induced beetle attack. [Photograph shown.]

An infestation treated by means of cut-and-leave looks like this, the only difference being that the trees aren't removed. They are just left on the ground. It is a very small area, often less than an acre in size, that is disturbed by the direct control tactic, rather than a maximum in the Four Notch area of 3,500 acres.

Mr. SEIBERLING. Does that complete your testimony?

Mr. BILLINGS. Just one more statement. The Little Lake Creek Wilderness area has a host type very similar to the Four Notch area. It is, in my opinion, only as a result of direct control in 1985 that the U.S. Forest Service was able to avoid a replay of this catastrophe.

So, based on personal experience of many years of applying these control tactics, and until better methods are developed through research, I think we cannot afford to discontinue control on these areas, particularly those areas that are very prone to beetle outbreaks.

Thank you.

Mr. SEIBERLING. Mr. MacCleery, given the many years and millions of dollars of research that the U.S. Forest Service has spent on southern pine beetles, don't you have any expert entomologists of your own on this important subject? Do you have to call on a State entomologist?

Mr. MACCLEERY. Yes, we do have people who are working in this area. However, we asked Dr. Billings to come because he is a recognized expert in this field. He has, as you can see, much experience, and he is recognized nationally and internationally as an expert in this area.

Mr. SEIBERLING. You don't have any recognized experts?

Mr. MACCLEERY. We have in the audience Dr. Robert Thatcher, who is the assistant director of the Southeastern Forest Experiment Station, whose responsibility is research on southern pine beetles southwide. He would be happy to discuss the research efforts that we have underway, and what our efforts have found.

Mr. SEIBERLING. What I was wondering was why he wasn't your witness instead of Dr. Billings.

Mr. MACCLEERY. Dr. Billings is recognized, has practical experience and has done extensive research in this area. The subject of this hearing was the technical and research basis for our control efforts.

Mr. SEIBERLING. You don't have anybody who matches him in expertise?

Mr. MACCLEERY. I would like to call on Dr. Thatcher to answer that question, if I might.

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Mr. THATCHER. Would you restate the question, please, Mr. Chairman?

Mr. SEIBERLING. My question was whether the Forest Service has anybody who matches the expertise of Dr. Billings on southern pine beetle.

Mr. THATCHER. Mr. Chairman, my present position is that of Assistant Director of the Southeastern Station. Until last September 30, I was the manager for the South-wide IPM RD&A program. Dr. Billings was a cooperator in that program, and received funding for his research and technology transfer in eastern Texas.

I have a broad perspective on various questions that relate to the southern pine beetle problem based on 11 years of experience. I would be pleased to answer any questions that you would like to address.

Mr. SEIBERLING. Do you have the same credentials as Dr. Billings in this field?

Mr. THATCHER. My background is in research at the Southern Forest Experiment Station. Dr. Billings is in an action program, if I can use that kind of phraseology. It has been our responsibility to develop the knowledge, and his to carry out the technology transfer and actual use. We have funded an extensive demonstration project in eastern Texas that he was principally responsible for over the past several years.

Mr. SEIBERLING. I see. In other words, he was engaged by the Forest Service as a consultant?

Mr. THATCHER. No. He was funded as a principal investigator for a continuing study done by the Texas Forest Service.

Mr. SEIBERLING. Do you have any comments to add to his testimony?

Mr. THATCHER. No, sir, I do not. I think he adequately described what was accomplished in Texas and expressed the concerns of the State forestry organization.

Mr. SEIBERLING. All right, thank you.

Mr. MacCleery, the Forest Service has repeatedly stated that it cuts trees to control beetle populations in wilderness areas to prevent the spread of the beetle to private lands or nonwilderness forests. Do you acknowledge that in the process you are decreasing the amount of less susceptible mixed pine and hardwood acreage and increasing the acreage of even-aged pine monocultures, which are more susceptible to beetle attack?

Mr. MACCLEERY. In the process of doing what?

Mr. SEIBERLING. In the process of cutting in wilderness areas to prevent the spread of the beetle.

What is the effect of cutting on the composition of the stands? Does it allow the continuance of the pine monoculture, or does it produce more mixed pine and hardwood acreage when you cut these tracts?

Mr. MACCLEERY. If the infestation is allowed to run its course and cover thousands of acres, the normal process would be for the mature pines to be killed. In the natural process, fire would follow, and after the fire burned the area, pines and the less tolerant hardwoods might come in. The result would probably be a mixture of pine and hardwood. It would take many years for a mature stand to reoccupy the area.

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Mr. SEIBERLING. What is the typical tree composition of climax forests in east Texas?

Mr. MACCLEERY. I will let Mr. Daily answer that question.

Mr. DAILY. Only in areas of fire climax would you find extensive acreages of long-leaf pine, short-leaf pine, and loblolly pine and hardwood. In 1902, when initial investigations were made, that was the forest that existed. Since that time, we have controlled fires. We use roads and other sorts of fire breaks to disrupt it. Today, you would probably find an oak-hickory climax in the uplands, and bottom-land hardwoods in the lower elevations. The climax forest would consist of oak species, including water oak, will oak, and cherry bark oak.

On the lower coastal plains, you would have tupelo gum and cypress.

Mr. SEIBERLING. So the typical climax forest in this part of Texas is hardwoods with some pines mixed in; is that correct?

Mr. DAILY. In the absence of a fire, that is what happens, yes, sir.

Mr. SEIBERLING. I would like to ask you, Dr. Billings, to what extent is the southern pine beetle problem aggravated by the emphasis on softwood monoculture in east Texas?

Mr. BILLINGS. Clearly, the pine beetle only feeds on pine. However, some of our more extensive beetle infestations in Texas have occurred in southeastern Texas, in the Big Thicket, where we have a mixture of pine and hardwoods. In many of these areas, once the beetles get started, they can move through a stand that is primarily hardwoods.

Mr. SEIBERLING. They don't attack the hardwoods.

Mr. BILLINGS. They don't attack the hardwoods. They eliminate the pine from the pine-hardwood mix.

Mr. SEIBERLING. Isn't that the natural succession then?

Mr. BILLINGS. It may be in those areas.

Mr. SEIBERLING. In other words, this problem really arises because of our tinkering with the ecosystem; isn't that really what it comes down to?

Mr. BILLINGS. The fact that we are growing more pine than we have in the past, no doubt, has added to the problem; for the same reason, we have more corn and wheat insects and other insects.

Mr. SEIBERLING. When I was down in east Texas several years ago, we were visiting some of these areas, and I noticed that after they would harvest pines in a particular part of the national forest, they would also knock down the hardwoods. We were told that in previous years, they used to also poison the hardwoods. I asked why they did that. They said because if they don't, the hardwoods will take over and we will have less pines and more hardwoods.

Mr. BILLINGS. On commercial forest lands, to date, the value for timber production has been in pine. You get very little revenue for the hardwoods. This may be changing, but right now, on industrial lands, the money is in pines, so they favor pine growth.

Mr. SEIBERLING. So, isn't the real problem here that the threat to private land posed by beetle infestation in pine stands is greater than the threat from infestation in mixed hardwood wilderness? In other words, the greatest risk of beetle infestations spreading is in the wilderness areas that are mostly pine rather than mixed areas.

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Mr. BILLINGS. That is correct. In Texas, many of the areas that were designated for wilderness have an inordinate abundance of pine. Many of them, I believe, were set aside because of these large mature pines. These were forests that, up until very recently, were being managed for pine timber and other resources, but primarily pine. To lock them up as wilderness now does enhance the beetle problem until you get a more diversification of age classes and species in those wilderness areas.

I would like to add that prompt beetle control and the opening of these stands with small clearings for beetle control may help in the long run in diversifying these age and species structures within wilderness areas, making them more resistant to beetles in the long run. Whereas, if you just let the beetles run rampant in the area, they are liable to wipe out the entire overstory, and after a fire, you are likely to return to pure pine again in these areas.

Mr. SEIBERLING. You mean if there were a fire, the forest would regrow as pine rather than hardwood?

Mr. BILLINGS. That is correct. By removing the overstory, you favor Sun-loving species. If a fire goes over the area, you provide a seed bed for pines, and you are liable to be back to mostly pine in those areas. Whereas, in my opinion, if you control beetle spots and keep them small, opening up small openings and maintaining shade in the area, you are favoring existing hardwoods and favoring regeneration of more hardwoods in pockets that will eventually diversify the area.

Mr. SEIBERLING. I find that hard to understand. If you cut an area, isn't it going to regenerate in the same manner as it would if it were burned? In other words, there is no cover.

Mr. BILLINGS. With control efforts, we try to limit those cuts to one to two acres, small areas.

Mr. SEIBERLING. Well, aren't the hardwoods going to regererate in the areas that are solid pine which haven't been cut?

Mr. BILLINGS. As long as you maintain the overstory shade, you will get an understory of hardwoods coming up under it. It will take a few years for those hardwoods to get established.

Mr. SEIBERLING. I see.

Mr. BILLINGS. We, in my opinion, need to maintain that overstory of pines to provide the necessary shade to favor the climax hardwoods. And you are risking losing that as well as the threatening the neighboring landowners in a beetle infestation if you let nature take its course in the next few years.

Mr. MACCLEERY. If there were existing hardwoods in the area that was cut, and there is no fire, then the hardwoods would take over the area.

Mr. SEIBERLING. I understand that before Judge Steger ordered you to stop it, that the Forest Service was also knocking down the hardwoods when they went in to cut these areas. Is that correct?

Mr. DAILY. Mr. Chairman, there were occasional hardwoods that had been cut. It was unintentional. It was not an act of going in to eliminate the hardwood. They were removed during the cutting operation when there were hardwood trees in close proximity to the pine. They were judgment calls made primarily for safety. They felt that the hardwood trees would be better removed so they would have a safer opportunity to cut down the pine trees.

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But you are absolutely correct, there were some hardwood trees that were cut as a result of the control operation. We have made an all-out effort since that time in, compliance with Judge Steger's orders, to ensure that hardwood trees are not cut. Occasionally, though, hardwoods must be cut, and in those cases we have been documenting the necessity with photographs explaining the specific situations.

Mr. SEIBERLING. Doesn't the Forest Service in east Texas now, because of the importance of softwoods commercially, have a conditioned reflex against allowing hardwoods to proliferate? Isn't that part of the problem that led to the cutting of these hardwoods? I certainly had that impression when I was down there. Softwoods were desirable and hardwoods were dogs.

Mr. ROBERTSON. Mr. Chairman, I had the fortune to work in Texas in the early sixties in some of these areas we are talking about. And 25 years ago there was a lot of effort toward growing pine trees and eliminating hardwoods. But 25 years ago, when I was there, we made a change, recognizing the importance of the hardwoods, particularly in the stream drainages, as well as other sites away from streams. I can tell you that 25 years ago we made a deliberate decision on the Texas National Forests that hardwood was an important component of the Texas National Forests, and we have been managing hardwoods as such since them.

Mr. SEIBERLING. Well, I have used up my time.

Mr. Strang.

Mr. STRANG. Thank you, Mr. Chairman.

I think we are getting ourselves a bit like the sparrow that flew into the badminton game, because if indeed it becomes public policy that we encourage these forests to move to their climax, a forest which is a hardwood forest—essentially that is what we are talking about—we also apparently have a legal obligation to safeguard the woodpecker, which lives in pine.

How do those two trends work themselves out?

Mr. MACCLEERY. A forest which is entirely at climax would not be a natural forest anymore than a forest that is entirely pine would be. A natural forest is subject to disturbances such as fire, insect attack, and wind storms that created a forest that is a mosaic of pines and hardwoods.

Mr. STRANG. So it is your belief we can pursue our, what might turn out to be a policy of encouraging greater hardwood growth still enough pines in there to provide habitat for the woodpecker?

Mr. MACCLEERY. You are entirely right. If these forests move toward climax and the old growth pines are eliminated and replaced by hardwoods, the habitat for the red cockaded woodpecker would not exist.

Mr. STRANG. Mr. Billings, these forests, are they mostly planted forests that we are talking about that are going into these wildernesses? Were they planted by man for commercial purposes?

Mr. BILLINGS. Yes. I don't believe we have any of what we call original forests in Texas. They were all cutover back in the 1920's and 1930's, and most of them either regenerated naturally from that cutting or were hand planted.

Mr. STRANG. So in the lifetime of a few people in this room, they have then been designated as a wilderness, untrammeled by man.

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Mr. BILLINGS. That is correct.

Mr. STRANG. That is fascinating to me. Our good friends from the Sierra Club have filed a suit, I gather, to prevent treatment of this, and it is wonderful to have this kind of help. We get it in water problems as well.

Are there any natural predators to this southern pine beetle?

Mr. BILLINGS. Yes. There is a long list of natural enemies, predator beetles, and checkered beetles that feed on the southern pine beetle both in the adult stage and under the bark. There is a series of parasites that will lay eggs on various life stages of the beetles as they develop in the bark.

I think that is another key point concerning control tactics that we are now using. In the 1960's, when we applied toxic chemicals, there were some great and, I think, valid concerns that we were doing more harm than good by killing off these natural enemies. Right now it has been 15 years since we used chemicals. We have seen a bounce back of these natural enemies. They are very abundant. Unfortunately, they are not capable of preventing outbreaks any more than our control tactics are, but no doubt they do help out.

Mr. STRANG. In the State of Texas you have done some absolutely magnificent work with the sterilized fruit fly. Is that the fly that causes screwworm?

Mr. BILLINGS. That is correct.

Mr. STRANG. By releasing enormous amounts of sterilized, irradiated males. Is there any way that kind of a procedure could be done in this area or not?

Mr. BILLINGS. No, there is not. That has been suggested by many nonentomologists because it is a classical technique for eradication, but we are dealing here with a native insect, one that would be very difficult to rear in large numbers, and there are many other attributes that are different from the screwworm. This approach is not possible.

Mr. STRANG. Mr. Secretary, I was interested in your testimony, as well as in Mr. Billings' testimony.

What would you do with the trees that you took off the wilderness area if you were able to go ahead with this program? Would you be permitted to sell them?

Mr. MACCLEERY. Our policy regarding wilderness areas would be to do as little disturbance as possible, and building roads and taking the trees out would not be consistent with that objective. We would do the minimum necessary to control the insect, which would be to cut the trees at an early stage in the infestation so that the area of disturbance would be minimized.

Mr. STRANG. Wouldn't you say that there is a suggestion that we should take perhaps one of these five wilderness areas and leave it as a test plot, so to speak? Would you say that perhaps the Four Notch Area has proven to be an adequate test plot?

Mr. BILLINGS. In my opinion, it has been. We have test plots going in the Big Thicket on the Big Sandy unit. Last year little or no control was done there, and we lost 5,000 acres out of a 12,000-acre unit.

The Beech Creek unit, back in 1976, the Lance Rosien unit, and the Loblolly unit, which is a misnomer now since all the pine trees

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were killed, are some of our numerous test plots, if you wish to call them that, where no control has been applied. In each case the results have been similar during beetle outbreaks.

Mr. STRANG. Are there any other species of pine that would be resistant to the spruce pine beetle and still provide a host for the woodpecker and still be commercially viable?

Mr. BILLINGS. The Southern pines?

Mr. STRANG. Some kind of a pine, a commercial tree, that the beetle wouldn't like but that the woodpecker would like and the loggers would like. Is there such a tree?

Mr. BILLINGS. Yes. Longleaf pine, which was much more predominant in earlier days, is more resistant to the beetles, and also provides nests and cavities for the woodpecker in many areas. Unfortunately, not too much longleaf pine has been grown in the last 40 years. They have been favoring loblolly pine and shortleaf pine, which are more susceptible.

Longleaf is slower growing in the earlier stages. It makes a beautiful tree and beautiful lumber, but it has a longer rotation and it is much more difficult to manage because of an early grass stage. Again, research is helping, and we may end up growing more longleaf pine in the future.

Mr. STRANG. Would the Forest Service, in an area that was devastated, a wilderness area, would the Forest Service entertain some sort of help in trying to reforest those wilderness areas with something that was resistant, like longleaf pine, Mr. Secretary?

Mr. MACCLEERY. Our normal approach in this kind of situation would be to allow the natural process to run its course and not plant in a wilderness area. If pines came in, pines would come in. If hardwoods came in, we would just let the process run its course.

Mr. STRANG. I thank you for your testimony.

Mr. Chairman, I would like to be able to submit some questions for the record, if that is possible, in the customary manner.

Mr. SEIBERLING. Sure.

Mr. STRANG. And I am most impressed with your bona fides, Mr. Billings.

Mr. BILLINGS. Thank you.

[EDITOR'S NOTE.—A series of followup questions submitted by Mr. Strang to the Department for written responses may be found in the appendix under cover of a letter dated, April 8, 1986. The Department's response to these questions were furnished in a letter dated April 29, 1986. See table of contents for page number.]

Mr. SEIBERLING. Mr. Sunia?

Mr. SUNIA. Thank you, Mr. Chairman.

As you know, I don't attend all the hearings, but this one particularly perked my interest because, as you know, I come from an area which had to fight a beetle which was feeding on our most vital plant, the coconut tree, a different kind of beetle and a different kind of tree.

But the problem was the same. It devastated an industry. As a matter of fact, we lost the copra industry in our islands because the beetles got to the coconut trees. I think we were successful finally in fighting the beetle off with a sterilization program.

I heard Dr. Billings say a little while ago that this would not be successful in that area down there, and I would like to know first

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if, in fact, we are continuing research in this particular area or whether we have convinced ourselves that it will not work or it is too far down the line, so we are not putting real emphasis on research in this particular method of fighting the beetle.

Mr. ROBERTSON. We are doing quite a bit of research now. In fact, we have done research on the southern pine beetle for the last 20 or 25 years and it is still a major research program in the Forest Service.

Mr. SUNIA. Are we getting close? How close are we?

Mr. ROBERTSON. I think I should call Dr. Thatcher to answer that question.

Mr. THATCHER. If your question is are we close to eliminating the southern pine beetle as a real problem in forestry——

Mr. SUNIA. I mean in our research are we close to finding a solution other than cutting?

Mr. THATCHER. The present thinking is that we are very close to having preventive control measures ready for use, including silvicultural approaches which are aimed at manipulating the forest, and dealing with the whole system that the beetle prefers.

I think Dr. Billings' demonstration project in two entire counties of east Texas, has gone a long way toward a live demonstration on an operational scale of the practicality of timely thinning of highly susceptible stands to either prevent the incidence or reduce the severity of loss.

Even in the face of high beetle populations in surrounding National Forests and industrial lands, we have achieved some marked survival of trees and lowered incidence of infestations in a fairly extensive area. I don't recall the exact acreage.

Dr. BILLINGS. A million acres.

Mr. THATCHER. It is 1-million-acre area. There is an impressive story there, and I hope, if the analysis of last season's results bear out his earlier findings, that he will publicize these results very quickly and extensively.

Mr. SUNIA. It seems to me that the major problem with the claim that cutting is a successful technique is perhaps with the definition of spot growth. I am not convinced that when you cut, you totally eliminate, because as I heard you, these beetles can fly for hundreds of feet, I do not know how many hundreds, and we cut in the hope of encircling them and yet they fly over hundreds of feet.

It seems to me that there is no sure way that we can keep them in that spot unless we have to cut a whole bunch, far more than the areas we saw in the pictures.

Mr. BILLINGS. You are correct in assuming that we probably cannot be 100-percent effective in keeping the beetles in that spot. What we can do, however, is eliminate that source of pheromone which is critical. Once the beetles leave that spot and fly to the uninfested forest, they can't stop anywhere there is a pine tree and start up a new infestation because they are low in numbers and there are no more of these pheromones available.

They have to initiate that pheromone system again, and they apparently have a very difficult time doing this in the summertime and starting up these multiple tree infestations. Historical records show that they can do it in the spring and the fall, but are very unsuccessful, apparently, in the summer, once they are forced out

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of these spots and out of the influence of this continual pheromone attractant source.

So we are effectively preventing the mass aggregation that is induced by pheromones, secondary attractants if you will, and causing the beetles to search out individual weakened trees and start the whole spot growth process over, as their predecessors did in the spring. During the summer, the southern pine beetles are apparently very unsuccessful in initiating new infestations.

Some may survive in single, weakened trees and lightning-struck trees, but overall, the likelihood of survival is much greater within the spot without treatment than when you force them out during the hot weather in the summer. So that is the strategy being used, not to eradicate the beetles, but to aggravate them to the point that we are reducing our timber losses to levels that we can live with.

Mr. SUNIA. I don't want to take up all the time, Mr. Chairman. I think maybe Mr. Barton would like to get at the witnesses. I certainly would like to hear the other side of the story.

Mr. SEIBERLING. Mr. Barton.

Mr. BARTON. Thank you, Mr. Chairman. I have a few questions.

I would like to first point out, Mr. Chairman, when you were asking about the expertise of the Forest Service on witnesses, you weren't intending to impugn the expertise of a citizen from my great State of Texas. We do have some experts, although we do not have a monopoly in the field.

I would also like to thank you, Mr. Chairman. I am a fifth-generation Texan. My family has been in Texas since 1840 and I just assumed that east Texas was always pine, the piney woods of east Texas. Evidently that is not the case, so the gentleman from Ohio has educated the gentleman from Texas on his own State in that regard.

I do have a question about that. When the first settlers came to Texas in the 1500's and 1600's, there was a mixed forest in East Texas; is that correct? It wasn't totally pine forest?

Mr. DAILEY. In 1902 or 1904, the east Texas area was described as progressing from the southern coastal plains, which was a coastal marsh, into loblolly pine forest type, from there progressing northward into a pure longleaf pine type where the understory was open.

I have heard descriptions attributed to individuals who traveled from Zavalla, which is southeast of Lufkin, to Jasper, TX, in a wagon, as passing under a complete longleaf pine overstory. It was something like being in a park.

Mr. BARTON. What time period was that?

Mr. DAILEY. I am not sure exactly, but the last cutting of virgin longleaf pine forest in that area occurred about 1946, so this was some time prior, and I would suspect was some time in the 1920's or 1910's.

Mr. BARTON. I know if you go west of what I call the piney woods of east Texas, you hit the Posto belt, and there are very few pines except over around Bastrop where they have the lost pines. So just in layman's terms, would it be fair to say that historically in east Texas it has been predominantly pine, although there have been oaks, cypress and other hardwoods? Would that be fair?

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Mr. DAILEY. In the commercial forestland section of 10 to 11 million acres, you are correct. It has been described as piney woods. There were large portions of it that were in pure pine, either longleaf, or in the case just to the north of it, shortleaf pine at the time that the virgin forest was cut.

Mr. BARTON. I have a question for Dr. Billings on the pheromone research. How much is being spent on that right now, and how much would you like to have spent on it right now, and are there any environmental objections to such research should it prove to be feasible?

Mr. BILLINGS. Money has been spent on pheromone research. Most of the research money expired last September with the end of the Integrated Pest Management Program. However, we have some very interesting leads and we hope to continue pheromone research in Texas. We have a cooperative project to get the ball rolling again between myself and Dr. Tom Payne, subsidized with a very small amount of money from the Texas Forest Service.

But if we are going to develop an operational control tactic, I think we will need more extensive funding to fully evaluate these promising control tactics which deal with both attractants and inhibitors.

Mr. BARTON. Let me repeat the question.

How much has been spent; how many dollars?

Mr. BILLINGS. Perhaps Dr. Thatcher can answer how much has been spent by the U.S. Forest Service in the last 10 years on pheromone research.

Mr. BARTON. While we are finding out how much has been spent, how much would you like to see additionally spent?

Mr. BILLINGS. The reason I am hesitating is that most of this money on pheromone research in the past has not come directly to me, but to Dr. Tom Payne, so I don't have the figures at my fingertips.

Mr. ROBERTSON. We have spent about $8 million over the last 5 years on southern pine beetle control, and an estimate of about $500,000 dealing with pheromones.

Mr. BARTON. About $500,000 has been spent in the last 8 years. All right.

How much would anybody, Dr. Billings or the Forest Service people, if this panel were willing to request through the proper authorization procedure, how much could you effectively use?

Mr. BILLINGS. Dr. Tom Payne would like me to say all that you can spare.

Mr. BARTON. We can spare none. Under Gramm-Rudman there is none to spare.

Mr. BILLINGS. I believe that ideally, if we could continue at the level that we have had in the past for the next 4 or 5 years, we would be able to nail down some of these promising techniques, demonstrate them under operational conditions, and be in a much better position to possibly consider replacing some of the current control tactics.

Mr. BARTON. I still need a dollar amount.

Mr. BILLINGS. $500,000.

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Mr. BARTON. $500,000. Of course, we have some other witnesses who will testify on their own behalf, but are there any environmental objections to the pheromone approach?

Mr. BILLINGS. I have not heard of any. In contrast, I believe there has been support for more research on pheromones mainly because it offers a solution to the problem of having to cut trees, particularly within these wilderness areas. If we can attain the same objectives without cutting trees in a cost effective and practical manner, then I think that environmentalists would be all for it.

Mr. BARTON. As I understand the way you apply the pheromones, you take them out, an individual forester, with a little 5-gallon squirt apparatus and he sprays the tree. Is that the way it is done?

Dr. BILLINGS. Yes. The most promising technique that we have now is the use of an inhibitor. That is a compound that the male beetles put out to ward off other beetles, and we spray this on the trees that are just coming under attack, and on a buffer strip. We don't coat the whole tree, but just about a square foot area, and that is enough natural compound to disrupt the beetle behavior that causes aggregation and further spot growth.

Mr. BARTON. Have you attempted in any test case to use that to combat a southern pine beetle infestation?

Mr. BILLINGS. Under experimental conditions, we did treat two infestations in rather young plantations last year, and both were successful in disrupting spot growth with a minimum of tree killing, I think 8 to 10 trees following treatment.

Mr. BARTON. OK. What is your definition of successful? It didn't grow?

Mr. BILLINGS. That is correct. We also reduced timber losses that would have occurred without that treatment through our predictions on spot growth.

Mr. BARTON. Mr. Chairman, I would like to also submit some questions for the record. I appreciate your generosity in letting me sit in on this hearing. It is a problem in my district, and as I indicated, in Congressman Charles Wilson's district. Speaking for myself, I will be more than happy to work with you to try to develop an answer, and I hope that we could further investigate this pheromone research. That appears to have some real possibilities.

Mr. SEIBERLING. Thank you. Mr. Wilson sent me a note saying he wasn't able to be here today because his subcommittee is having a hearing on the CIA. Maybe we could take some of that secret money away from the CIA and use it for more constructive purposes.

Mr. Weaver.

Mr. WEAVER. Thank you, Mr. Chairman.

Were there trees in east Texas before Europeans came? It was all just plain, and we planted the trees.

Mr. BILLINGS. I assume that there were trees.

Mr. WEAVER. You assume?

Mr. BILLINGS. Yes, because in the early writings of explorers who came into east Texas, they did make reference to the forested nature of the area.

Mr. WEAVER. How did the trees manage to survive before we came in with our chemicals? Why didn't these bugs kill them all

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off? Man has done such a superlative job of keeping them alive, how did nature do it?

Mr. BILLINGS. Conditions apparently are different. The beetle mainly reaches these very high infestation levels when the pines are very closely spaced, very large diameter stands. There they are most prone to beetle outbreaks.

Mr. WEAVER. Excuse me. I am not following you. There had to be what?

Mr. BILLINGS. We no doubt have had southern pine beetle outbreaks in the past. It is a native insect and there may well have been outbreaks before man arrived. There are always a few pine trees that survive.

Mr. WEAVER. You mean before man arrived there was devastation, almost no trees, and they finally struggled back?

Mr. BILLINGS. I can't really say, but I expect that there were southern pine beetles and there probably was some tree killing. But we also had more extensive fires in those days, which would also be a natural factor to thin out these pine stands and make them less susceptible to the beetles.

Mr. WEAVER. Why don't we do that now?

Mr. BILLINGS. We do on commercial forestlands. The primary prevention method is to thin out the pines, and keep them growing vigorously.

Mr. WEAVER. Who set the fires back in the days before Europeans came, the Indians?

Mr. BILLINGS. Some were natural fires. Indians often set fires so that they could walk through those woods.

Mr. WEAVER. What happened? Why aren't there natural fires there now?

Mr. BILLINGS. Mainly because of fire prevention programs.

Mr. WEAVER. In other words, we are making the situation worse is what you are saying; right?

Mr. BILLINGS. In that way, yes.

Mr. WEAVER. OK. I just believe that nature did a pretty good job before we got in there, and I think we sometimes make a botch of things. The reason they are so closely spaced is also because we plant them that way. Is that true?

Mr. BILLINGS. That is correct

Mr. WEAVER. Do you plant different species than were there naturally?

Mr. BILLINGS. No. We have in the past planted some slash pine, which is not native to Texas. It is native to other parts of the South. But very little of that is being planted now. We plant mainly native loblolly pine and shortleaf pine, but primarily loblolly pine.

Mr. WEAVER. Where do I hear about monoculture? People keep telling me, "Gosh, it is monoculture now." Wasn't it always monoculture? Have we changed the pattern of trees? That is what I am asking you.

Mr. BILLINGS. Apparently we have changed some of the species composition. There is less longleaf pine, which is more resistant to the beetle, and probably more loblolly pine now than there has been in the past, because loblolly pine is more commercially valuable. It grows faster.

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Mr. SEIBERLING. If the gentleman would yield, earlier we had testimony that the typical climax tree composition of the eastern Texas forests is mixed hardwood, with just a few pines.

Mr. WEAVER. I see. That is what I wanted to know. I thank the chairman very much for that.

Mr. MacCleery, the environmental assessment authorizing the cutting of timber in the Black Creek and Leaf Wilderness Areas in Mississippi, indicates that the cutting is justified to protect surrounding timberland from beetles originating in the wilderness.

Yet, according to that assessment, I am told, 96 percent of the timberlands surrounding those areas is of low susceptibility to southern pine beetle attack. Would you comment, please?

Mr. MACCLEERY. If a large infestation is allowed to build up in a wilderness area or any other area, it can build up to such proportions that it will kill not only the highly susceptible pines, but also those which are less susceptible. It will kill any pines.

Mr. WEAVER. How did those forests manage to survive before we got there?

Mr. MACCLEERY. There is evidence that these indigenous forests such as lodgepole pine, as well as spruce fir, were subject over a period of years to cycles, some of which were catastrophic.

Mr. WEAVER. You know that? That is documented, these cycles?

Mr. MACCLEERY. With respect to lodgepole pine and with respect to spruce fir forests, that is true. With respect to the spruce fir forest, it is the spruce budworm. With respect to lodgepole pine——

Mr. WEAVER. What period of time are we talking about?

Mr. MACCLEERY. Periods of time extending over 50, 60, or 100 years.

Mr. WEAVER. I mean what years, 1700's, 1800's, 1900's, where you are talking about this documentation exists.

Mr. MACCLEERY. The research on the role of fire and insect epidemic in the natural forest has developed over the last 15 years, and there is a significant amount of evidence that these cycles of insect buildup and destruction of the forest, followed by fire, regeneration of the forest, young forests——

Mr. WEAVER. For what? Going back into prehistory?

Mr. MACCLEERY. That is correct.

Mr. WEAVER. There is evidence of that.

Mr. MACCLEERY. That is true.

Mr. WEAVER. Could you give us one of the best species for the record here, or at least for the file?

Mr. MACCLEERY. For what?

Mr. WEAVER. The documentation that you are discussing now. I would like to see it.

Mr. MACCLEERY. Certainly.

Mr. WEAVER. Good. Pick your best research on that. I would like to see it.

[EDITOR'S NOTE.—Information provided to Mr. Weaver in the form of several USDA-Forest Service research documents.]

Mr. MACCLEERY. We are now in a period, in many parts of the West, in which the mountain pine beetle is attacking the lodgepole pine. Similar epidemics occurred around the turn of the century.

The trees have matured. Large areas are maturing all at once, providing the source for large population buildups of mountain

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pine beetle. The normal cycle is for these beetles to build up and to kill the trees, for fire to come in, and then for the lodgepole pine to regenerate on those sites, and the cycle begins over again.

The period may be 50, 60, or 70 years from cycle to cycle.

Mr. WEAVER. Mr. MacCleery, wouldn't it be a good idea to have certain areas set aside, such as wilderness areas, so we could see the natural cycle, know what happens in it, and understand that natural cycle? Wouldn't that be a good idea? Wouldn't that be helpful to help us do the other 99 percent of commercial forestland?

Mr. MACCLEERY. It certainly would be.

Mr. WEAVER. An excellent answer.

Mr. Billings, one last question.

A 1979 article by Heden and Billings noted that small infestations with less than 20 infected trees rarely expand to larger infestations and such spots are considered the lowest priority in terms of control treatment.

Were you a party to that?

Mr. BILLINGS. Yes, I was.

Mr. WEAVER. You are one of the coauthors?

Mr. BILLINGS. Correct.

Mr. WEAVER. A March 1985 postsuppression evaluation of the southern pine beetle suppression project for Texas National Forests indicated that 40 percent of the spots with 1 to 25 trees in the San Jacinto Ranger District were treated in fiscal year 1983.

Do you know about that evaluation, and can you tell us why this was?

Mr. BILLINGS. I can explain the apparent discrepancy.

If you look at the title of our article, it refers to the growth of summer infestations. We looked at spot growth during a summer period, June, July, and August, when those small spots tend to die out. Back in March you may have a completely different story, and a 20-tree spot may be the focus for a larger infestation because beetles are dispersing throughout the area and may aggregate into those small spots, making a small spot become a big spot.

This phenomenon will usually cease by the end of May, and we have a different seasonal behavior than when we did our studies.

Mr. WEAVER. Thank you. A final, general question, Mr. Chairman, and that is, overall have we really done any good? Have we controlled these insects any better than nature.

Mr. BILLINGS. I believe we are doing our very best to cope with a very serious problem. We have been able to avoid catastrophes like the Four Notch in all but the four or five different instances where we took the no-control approach. I believe that direct control is not a permanent solution.

We are looking more toward permanent solutions through managing the forest type, as Dr. Thatcher said. We are learning better ways of living with the beetles, but the direct control methods buy us some time, and allow us to avoid severe losses until we come up with more permanent and ecological bases for managing beetle populations.

Mr. WEAVER. Call it a bargaining chip, I think.

Mr. MACCLEERY. I think ultimately the solution to many of these insect infestations, the southern pine and mountain pine beetle,

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and the spruce budworm problem, is through silviculture, so that we don't have large areas of the forest maturing all at once and providing this sort of a buildup potential. We need to develop a forest which is a mosaic of different stands, different species and different age classes, so you don't have this huge potential for buildup that we have in the current situation.

Mr. WEAVER. Thank you, Mr. Chairman.

Mr. SEIBERLING. Mr. MacCleery, how do you respond to observations that a number of beetle infestations appear to be equally distributed within and without some wilderness areas?

Mr. MACCLEERY. Dr. Billings has done some investigation of that. I will ask him to answer that question.

Mr. BILLINGS. Would you remind repeating the question?

Mr. SEIBERLING. How do you respond to observations that the number of beetle infestations appears to be equally distributed within and outside some wilderness areas? In other words, there doesn't seem to be an greater number of infestations within wilderness than outside of wilderness.

Mr. BILLINGS. On the contrary, my data, looking at counties across Texas that include wilderness and nonwilderness area shows on table 1 of my testimony that those tracts of land with wilderness have twice the frequency of beetle infestations as similar grid blocks in the same counties without wilderness and four times as many as private lands without National Forest lands or wilderness.

So I think that the contrary is true. In 1985, in particular we had more beetle infestations centered in and around our wilderness areas, and that is a reflection of a very susceptible host type that is still prevalent in those areas. So I disagree with that statement.

Mr. SEIBERLING. You don't present any statistical analyses of the variances of the mean, so it is possible that there is not a statistically significant difference between the mean number of infestations on private lands or those either near or far from wilderness.

Mr. BILLINGS. I didn't bother putting the statistics on this table, but we could show statistically that areas with wilderness are more prone, or were more prone in 1985, to have beetle infestations than the average similar acreage of industrial lands, private lands or much of the National Forest lands.

Mr. SEIBERLING. Could that reflect the fact that the Forest Service policy of cutting infested areas is increasing the number of Southern pine beetle spots by causing the beetles to disperse?

Mr. BILLINGS. No. I think the data there shows that those areas that were set aside for wilderness have an abundance of very susceptible host types. Many of the areas chosen for wilderness were selected because they had dense, mature stands of pine. They were areas where you are most likely to find beetle infestations. As a result, you are more likely to have problems develop in those areas once they are set aside.

So I believe it is a reflection of the abundance of the host type for the beetle in these areas.

Mr. SEIBERLING. You define beetle control to be effective if it works in a majority of situations, as I understand it. Can you define "majority" for this purpose?

Mr. BILLINGS. With cut-and-leave, our experience has probably been similar to the U.S. Forest Service in that we stop spots 70 to

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80 percent of the time with the first treatment, and probably 95 percent with the second treatment. Occasionally we have to go back with a third treatment. Salvage tends to have a little higher succes rate .

Mr. SEIBERLING. If it were 51 percent, though, it would still be a majority, wouldn't it? But you are saying it is more than that?

Mr. BILLINGS. It would not look as favorable if it were 51 percent, but the actual record is much higher than 51 percent.

Mr. SEIBERLING. I found quite interesting your appendix of scientific citations. All eight publications were written by you. Is this considered good scientific support, to quote yourself?

Mr. BILLINGS. No, I didn't plan to review the literature on the southern pine beetle. I think this has been well done in a number of USDA publications, technical bulletin 1631, for example, and proceedings of the IPM Program. It would lead to a much more lengthy document if I tried to do that.

What I tried to do is to show my past experience and expertise as contributing knowledge to the pertinent problem, so I have limited my references to my own work.

Mr. SEIBERLING. So it doesn't indicate there are no others?

Mr. BILLINGS. No, in no way. There is much more research backing the southern pine beetle knowledge and control tactics.

Mr. SEIBERLING. Right. I understand Congressman Bryant has to get over to the floor of the House right away, so we will allow him to make his statement, and then I have a few more questions for Mr. MacCleery.

Welcome to our committee. You were one of the principal authors of the Texas wilderness legislation, so it is particularly appropriate for you to testify today.

[Prepared statement of Hon. John Bryant may be found in the appendix.]

STATEMENT OF HON. JOHN BRYANT, A U.S. REPRESENTATIVE FROM THE STATE OF TEXAS

Mr. BRYANT. Thank you, Mr. Chairman. I am very grateful to you for letting me come forward with this testimony. I hope that my testimony adds to the list of questions you have for the fellows I have just replaced at the witness table here when they return.

Mr. Chairman, I hope that what I say today will assist the subcommittee in seeing through the sophistry that the Forest Service is dispensing to justify its pine beetle cutting program.

Dr. David Wood, of the University of California, and other nationally respected forest entomologists have presented sworn statements that there is no scientific proof that buffer cutting controls the population or movement of southern pine beetles.

In reply to that, the Forest Service entomologists have said many times that they were not cutting to control the population or movement of southern pine beetles. I quote from an affidavit of Forrest L. Oliveria, who is with the U.S. Forest Service in Pineville, LA, a witness for the Forest Service in the Texas southern pine beetle case, and again in the Washington, DC, case.

"The affidavit by Dr. David L. Wood indicates that he is of the opinion that no direct control methods for the treatment of south-

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ern pine beetle infestations have scientifically been proven successful in either controlling population size or in preventing population movement."

The affidavit goes on to say:

"Controlling population size or preventing population movement," as suggested by Wood, "is not the purpose of the U.S. Forest Service southern pine beetle control program."

That is them talking about their own program. It is not the purpose to control population size or prevent population movement. That statement raises the logical question: If the cuts are not known to control populations on an areawide basis and are not known to control movements of beetles from one spot to a different spot, then why should the Forest Service be allowed to cut in wilderness areas at all?

My answer to that question is that they should not be allowed to cut in wilderness areas. The Forest Service has stated many times its two overall objectives of cutting inside wildernesses: First, to contain infestations to wilderness areas; and second, to prevent infestations from spreading to red cockaded woodpecker colonies. That is how they justify cutting in a wilderness area.

I have attached to my statement a paper listing 12 Forest Service statements to that effect. It seems very clear to me that in the absence of proof of controlling larger areas, the control of individual spots cannot be accepted as preventing southern pine beetles from infesting pines outside wildernesses. Yet, the Forest Service implies that control of spots must somehow aid in the protection of totally distinct and separate spots elsewhere. They just imply it.

The Forest Service position might not be so obviously phony if all their cuts in wildernesses were on the boundary line, but that is not the case. They are cutting as deep within the wilderness areas as possible. In Upland Island, that is up to 1½ miles inside boundaries which are only 3 miles apart, they are cutting even further away from red cockaded woodpecker colonies. Again, that was one of their justifications for cutting in the wilderness area, to keep the beetles away from those colonies.

Here is what is happening: The Forest Service is not able to hire entomologists who are willing to claim proof that cutting in one or more spots will stop the beetles in other places. Their entomologists will not challenge the independent experts who testified to the contrary head on. So what they try to do is leave the impression that their cutting actually has the effect that they admitted they could not prove it has.

That is misleading, at best, and in my opinion downright deceptive.

Here is what the Forest Service witnesses go on to say: They say that their cutting is effective. When pinned down, they say they mean that they can control individual spots, but their definition is highly self-serving. To the Forest Service, control or success means that after a spot has been cut once or more, the beetles no longer infest any of the pines immediately adjacent to the cut, but if the beetles fly to other pines 25 yards away or ½ mile away, as they often do, the Forest Service counts that as a fresh spot and counts the former cut as a success.

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They say they have controlled the first spot because that is all they meant by control. Using their definition, it is inevitable that they will claim a very high rate of success and the more destructive cutting they do, the greater successes they will claim.

Another way they put it is that the control is achieved when there are not more breakouts from a spot they have cut. They define a breakout as follows: When southern pine beetles emerging from a treated spot attack neighboring, immediately adjacent trees, when uninfested host trees are located between the treated spot and the new infestation, when the new infestation is considered a separate spot. The breakout must occur within 30 days of treatment of the spot. That is how they define a breakout.

There, again, I have quoted in what I just said the testimony of the Forest Service's own expert, Oliveria, in the Washington, DC, case now pending.

In Forest Service bureaucratic language, all they have to do to succeed is to keep on cutting breakouts until the beetles fly a short distance outside the buffer. Of course, the beetles are still boring away but they just had to move to do it.

The Wilderness Act of 1964 calls for areas to be left unmarred, except as may be necessary in the control of fire, insects and disease. The definition of "necessary" is "essential to a desirable or projected end."

Regarding buffer cutting in wilderness, the Forest Service's end is to protect commercial pine timber outside the wilderness. There is no proof that the cutting achieves that end. Therefore, it is not essential to that end and, therefore, it is not necessary. Since it is not necessary, in my opinion, it is clear that the Wilderness Act does not allow it.

I ask the subcommittee to put a stop to the buffer cutting for southern pine beetles in all federally protected wilderness areas where they exist.

Last summer during an inspection of beetle cutting conducted by this subcommittee, I stood in a clearing of about 100 acres in what had been a deep and shady forest well inside the Upland Island Wilderness. The forest ranger told our group that after a small infestation of beetles months earlier, they cut buffer after buffer, and each time the beetles had broken out, until finally, after 27 cuts, the Forest Service had achieved control.

I pointed out that there were three new spots just outside the wilderness boundary which we had observed enroute and I asked, "How can you claim to have controlled the beetles if they flew outside the boundary and started new spots?" to which he replied, "There haven't been any new, infested trees adjoining this cut for 30 days."

I said, "But you did not keep the beetles from infesting the lands outside the boundary," to which he insisted, "But we kept them from enlarging this spot."

We have already lost 100 acres of forest in this one wilderness area alone, if the beetles had infested the pines outside our wilderness anyway, exactly what the Forest Service says it is attempting to prevent, but by Forest Service standards, the cutting was a success.

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Mr. Chairman, I say those standards are ridiculous and in no one's interest. I suggest we ought to take this entire panel and investigate their academic backgrounds, stop Federal aid to whatever universities they went to, and submit to the Director of the Forest Service that he ought to hire some other experts if they are going to use this kind of ridiculous reasoning.

I would like to show the committee some slides, if you have a moment. We have six of them only; not a lot of them. These will show just exactly what these cuts mean.

Mr. SEIBERLING. Do you want to go to the Floor and vote?

Mr. BRYANT. I assume this is a vote on the Journal, Mr. Chairman; is that correct? I will make that sacrifice for the pine trees.

Mr. SEIBERLING. I will do the same.

[Slide.]

Mr. BRYANT. This is a picture of the Forest Service's work in protecting the forest in the southeast corner of Little Lake Creek shortly before we dedicated the wilderness in January 1985. That is 30 acres. That shows you an example of what this cutting operation means.

That lumber, by the way, was sold. [Slide.]

This is the Upland Island area of the wilderness. We have a series of cuts and breakouts near the National Champion Longleaf Pine depicted here. There are 27 cuts next to each other, about 100 acres in the next three slides. [Slides.]

This is a beetle spot in a picture taken, I believe, by Ned Fritz, that was never cut. This is like the one at the edge of the foregoing Upland Island cuts. There is shade, ground cover and soil that is not damaged by the dead pines. It is obviously much better than a logging operation. I think this slide was taken at the Big Slough Wilderness. It is quite similar to the one at the Upland Island that was on the congressional tour which this committee took in July 1985.

Mr. Chairman, the point of these slides is simply to demonstrate clearly the kind of devastation that is wreaked by these ridiculous cuts allegedly to stop the spread, at least impliedly to stop the spread of southern pine beetles, but as I said in my testimony earlier, when you pin it down, they have to retreat back to saying, well, they are only trying to control the growth of the spot.

I think it is a very devious way to avoid a logical, rational analysis of whether what they are doing has any effect or not.

I wanted to submit those to the committee simply because I understood the committee had seen a bunch of dramatic pictures of how bad pine beetles are. I wanted to show the committee how bad those who employ totally illogical reasoning to control pine beetles can be also.

It is clear to me that when the beetles are infesting trees throughout the forest, we do not protect any part of the forest by cutting spots, any more than we could protect part of a person's body during a case of the measles by cutting the spots as they broke out. The experts agree that when pine trees become too dense, pine beetles will periodically peak and destroy some of them and we cannot curb the epidemic by cutting spots.

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In wilderness areas, cutting does not just cause tremendous harm; it defeats the purpose of establishing the wilderness in the first place.

Mr. Chairman, I think that we have also submitted to the subcommittee photographs as well as an opportunity to do the slides that were just shown to the committee.

I strongly urge the committee to do all in its power legislatively, drawing public opinion to focus on this problem, to stop this crazy business of cutting these spots. It doesn't make any sense.

I was a personal witness to how absurd it was. I stood there with the gentleman who I believe is the director of that entire region for the Forest Service, walked alongside him and his men who worked in that region. A couple of them are here today. They just flat cannot explain why they have cut spot after spot. It is the most ridiculous and destructive thing I have ever seen, and if ever there was a reason to be angry at mindless bureaucracy, it was the day that I was in the wilderness area with the Forest Service, trying to get them to explain to us why they were cutting down the very trees we had endeavored to protect.

Mr. SEIBERLING. Are they doing the same thing in nonwilderness portions of the national forests?

Mr. BRYANT. I don't know, Mr. Chairman.

Mr. SEIBERLING. I will ask them.

Mr. BRYANT. I would like to know the answer to that. I guess that they are, but I don't know.

Mr. SEIBERLING. Dr. Billings, the Texas Forest Service scientist, testified that when you cut one of these infested spots and put a buffer zone around it, the beetles, when they fly to adjacent areas—if they make it to adjacent areas—don't produce the pheromones that are necessary to attract large beetle numbers and therefore generate a serious infestation. This is why cutting supposedly does control spot growth.

I wonder if you have any comment on that?

Mr. BRYANT. Has he changed the Forest Service argument that they are now cutting to stop the spread of beetles?

Mr. SEIBERLING. He showed pictures in the Four Notch area where they started out in a wilderness study area with a 10-acre infestation which they allowed to grow. It eventually covered over 1,000 acres in the absence of any cutting. Then he showed other pictures where they had cut out spots with the area around it clearly not infested, at least as far as you could tell from the pictures. So that was the basic thrust of his testimony.

Mr. BRYANT. Mr. Chairman, the testimony that I offered and quoted, and submitted along with the testimony that I offered, 12 examples of what the Forest Service has said, simply is that they don't cut to stop the spread of pine beetles. They cut to stop the growth of the spot.

Mr. SEIBERLING. They claim that the spots will eventually permit the spread of the beetles. In fact, they said in the case of the Four Notch area, that uncontrolled spots started infestations outside of the Four Notch area.

Mr. BRYANT. My recollection of the situation at Four Notch is that they cut the area so severely it would be pretty difficult to determine whether anything was stopped or not in that area.

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Mr. SEIBERLING. I don't think Dr. Billings or Mr. MacCleery said they can control the populations, but that they could control the spread of a spot. I think that is what their claim was.

Mr. BRYANT. I would just stand on the statement that I submitted to the committee. I stood there in the middle of that wilderness area, having seen three big spots on the outside of the wilderness as we drove in there, and asked, "How do you claim this to be a success? You shooed the beetles out of this area and they went over to that area."

Mr. SEIBERLING. What did they say to that?

Mr. BRYANT. They shake their heads and say, "Well, we are not sure." Their reply is indistinct. The ground of the argument constantly shifts. That is, in effect, what takes place. What they said to me at that time was that we kept them from enlarging this spot, to which my reply would be, "I thought you said you were trying to save commercial timberland. You are not supposed to be trying to cut in the wilderness area, according to your own admission. You are supposed to be trying to save the surrounding commercial timber."

That is what they tell the local folks down there who get so worried about this.

Mr. SEIBERLING. I think the theory is, and I hope they will correct me if I am wrong, that if they control the spots then the beetle will not spread to other private lands outside of the wilderness area, and if they don't, they say it will inevitably spread.

What you are pointing out is that it spreads anyway. Is that basically what you are saying?

Mr. BRYANT. First, that their official position is that they have no evidence that they can control the movement of the pine beetles outside the boundary of the wilderness. They say, when pressed, because they don't have any evidence that they can control the population or the move, that they are not trying to control the population or the movement, they are trying to stop the growth of the spot.

That is what they say, but they imply, in order to gain public support for their position, that they are controlling the spread and the population. When you argue with them down in east Texas, you don't talk about growth of the spot, you talk about jumping over the boundary to go to other areas, and that is how they manage to get a big crowd of angry residents up there to support their position.

Mr. SEIBERLING. My feeling is that if it weren't affecting any other area, we should leave the wilderness alone and let nature take its course. But the Forest Service argument is that if they do that, then there will be more beetles, rather than less, spreading to other areas.

I think that is their position and I am still not clear how they prove that, but that is their argument.

Mr. BRYANT. I submit that I don't think there is any scientific evidence to back up their theory at all.

Mr. SEIBERLING. That reminds me, with respect to wilderness areas, of the famous remark by the major in Vietnam who said "We had to destroy the village to save it."

Mr. BRYANT. Somewhat similar.

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Mr. SEIBERLING. Thank you very much.

Mr. BRYANT. Thank you, Mr. Chairman.

Mr. SEIBERLING. All right, Mr. MacCleery and company, if you will resume we will try to wind this up.

Do you wish to comment on Mr. Bryant's testimony, Mr. MacCleery?

Mr. MACCLEERY. It boils down to a statement you made right at the beginning in the introductory statement: the controversy is about whether the control technique that is being applied is, in fact, effective or not. Based on our examination of the evidence, and based on observing many, many spots, both controlled and uncontrolled, and statistically analyzing those, there is a definite correlation between the action of either cut-and-remove or cut-and-leave and stopping the spread of these spots which, if left untreated, would enlarge to very large infestations.

I could ask Dr. Billings to talk more about the studies which have identified the statistical basis for that conclusion.

Mr. SEIBERLING. Let me ask you, Dr. Billings, didn't you say in an article, Tech Bulletin 1631, on page 187, that:

"Effective control at the area level is seldom attainable due to various practical constraints."

Is that a correct quotation?

Mr. BILLINGS. Again, what we are talking about there is population control over a large area.

Mr. SEIBERLING. How big an area?

Mr. BILLINGS. Six million acres.

Mr. SEIBERLING. So it is seldom attainable.

Mr. BILLINGS. What I am saying is that the control we apply in 1986 may or may not affect what we suffer in 1987, because in the interim the beetle has gone through seven generations. It can bounce back if host conditions are right and we are dealing with a very large area of mixed ownerships.

On the other hand, we can show that we could prevent these large infestations that threaten private lands through prompt control, and prevent the buildup of 1,000-acre bug spots that are likely to develop in these areas if we take the approach recommended by Congressman Bryant of no control. I think we have ample evidence of that.

Mr. SEIBERLING. Are there any examples of effective control on an areawide basis?

Mr. BILLINGS. I don't believe we have seen population control for any insect that I know of other than the screw worm. Agricultural insects are a good example.

Mr. SEIBERLING. The pine bark beetle?

Mr. BILLINGS. Not that I know of. Population control, no.

Mr. SEIBERLING. So aren't we just spinning our wheels?

Mr. BILLINGS. No, we are not. That is the whole basis of my testimony, that we can demonstrate damage control, preventing timber losses and preventing the buildup of concentrated beetle populations in a limited area, such as wilderness area, where, once they build to those levels, the beetles can threaten surrounding areas in the immediate vicinity. This we have demonstrated, and we can do this without aggravating the spread of beetles.

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Mr. SEIBERLING. I find it inconsistent with the statement that there is no effective areawide control. You say you can control it, but you can't.

Mr. BILLINGS. We can control infestations. We may not be able to control the total beetle population because we do not intend to do that. We are not using techniques that totally eliminate the beetle.

Mr. SEIBERLING. But isn't the total number of infestations dependent on the size of the beetle population?

Mr. BILLINGS. Not necessarily; 1,000 one-tree spots are completely different than 1,000 thousand-acre spots. We are trying to keep the spot size to a minimum because it is the large spots that cause the damage. If we can keep the infestations at 30 trees or less, the beetle causes very little economic damage. Above that level, it can persist in an area, spread to adjacent areas, build up high local populations, and aggravate the local situation.

Mr. SEIBERLING. What has been the effect of the lack of treatment of beetle infestations in wilderness areas in Louisiana, Mississippi, and Arkansas since last July?

Can you tell us, or Mr. Robertson?

Mr. ROBERTSON. Since July?

Mr. SEIBERLING. Yes.

Mr. ROBERTSON. There has been very little activity. In fact, there has been no activity or control action taken in Arkansas or Louisiana. The Kisatchie Hills Wilderness Area is a problem and there has been action taken on two spots since July, and a cut of about 5 acres.

Mr. SEIBERLING. Is any research being conducted on the effects of nontreatment of those areas?

Mr. ROBERTSON. I don't know of any research specifically dealing with the Kisatchie Hills.

Mr. SEIBERLING. What about the other areas in Louisiana and Arkansas?

Mr. ROBERTSON. No.

Mr. SEIBERLING. Wouldn't that be a good idea?

Mr. ROBERTSON. We need to do research on population dynamics. I don't know that it has to be done in a wilderness area, but we do need to have a better understanding of population dynamics.

Mr. SEIBERLING. But wouldn't that be a logical place to do it, to try to see if you can minimize cutting?

Mr. ROBERTSON. Yes, that would be as logical as any other place.

Mr. SEIBERLING. It would be more logical, wouldn't it?

Mr. ROBERTSON. In one way it would. I would like to say that if we could control the beetle within the boundaries of the wilderness area we would let the beetle go. We would not take any action to control the beetle within the wilderness area if we could prevent it from escaping, or if it would not escape.

The only exception to that would be control actions to protect the red cockaded woodpecker.

Mr. SEIBERLING. Doesn't it affect the red cockaded woodpecker when you have chain saws and trucks and tractors and everything making a big mess right next to them?

Mr. ROBERTSON. In wilderness, we don't have the trucks and other things. We do have the chain saws. Yes, I suppose that is some disturbance of the woodpecker.

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Mr. SEIBERLING. Your affidavit to the D.C. district court 2 weeks ago stated that the Forest Service will cut infested pines within one-quarter mile of woodpecker colonies that appear threatened, but to protect private land you cut 1 mile or more away from the private lands.

Why is it adequate to cut within one-quarter mile of an endangered species but you have to cut farther than that to protect private land?

Mr. ROBERTSON. I can't answer that. I was aware of the one-quarter mile on the red cockaded woodpecker. I was not aware of the mile on private land.

Mr. SEIBERLING. If you cut in the middle of a wilderness, you are cutting more than 1 mile away. I suppose the answer is that if you don't, it will spread. That is Dr. Billings' premise.

Mr. ROBERTSON. We examine the individual spot and the individual situation. We have entomologists, wildlife biologists, and other people who examine the situation. We have growth models that, based on the factors that are present, can predict over the next 90 days or so what is likely to happen in that particular situation.

We then make a decision on a case-by-case basis. Our decisions are based on that kind of an approach rather than whether it is more or less than a mile. For the red cockaded woodpecker, we have set a one-quarter mile limit based on past experience. Within one-quarter mile, you may be getting into a threatening situation, and we may take action when an infestation gets that close.

Mr. SEIBERLING. Do you consult with the Fish and Wildlife Service in these matters?

Mr. ROBERTSON. Yes. We have a wildlife habitat management handbook that governs our management activities and provides guidelines relating to the red cockaded woodpecker. We have worked with the Fish and Wildlife Service, and have consulted with them on those guidelines.

Mr. SEIBERLING. All right. What I keep groping for is a scientific substantiation of the statements that cutting of infested trees and green buffers reduces the level of destruction of forest that would otherwise be attacked by the beetle and reduces the potential for the spread of the epidemic.

Does the Forest Service have areawide data from infested areas that were treated with cutting, compared to untreated areas with similar infestations? Do you have data, other than photographs, of the Four Notch area, for example?

There is an area that was not treated. Do you have data for areas that were treated so that you can compare?

Mr. ROBERTSON. Yes. In fact, the Texas National Forest has done quite a study on the treated areas, and in 1984 and 1985 they monitored 2,891 spots that were treated, and 77 percent of the ones that were cut-and-leave were effective in stopping the spread of that spot after a single treatment.

In the case of cut-and-remove, 89 percent of the spots that were treated were successful in stopping the spot from advancing or spreading.

Mr. SEIBERLING. Yes, but those were only with respect to the area right around the spots.

Mr. ROBERTSON. Yes.

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Mr. SEIBERLING. In other words, have you taken, say, 100 square miles of national forest or forested land and 100 square miles somewhere else and compared one where these actions were taken and another where they were not? In other words, do you have any control areas that you can use to test this theory against?

Mr. ROBERTSON. The Texas Forest Service has been looking at this. Our best control areas are on the Big Thicket National Preserve, of 85,000 acres, of which much is in pine, which is essentially managed under a no-control policy by the National Park Service. They have compared the Big Thicket National Preserve to adjacent lands that are in private or National Forest lands, where control practices are applied.

Some of our biggest losses continue to occur on the Big Thicket National Preserve, including 5,000 acres last year on the Big Sandy Unit and probably close to 1,000 acres on the Beech Creek Unit. We had nothing near that size on managed forest lands.

Mr. SEIBERLING. But the question is, Is there any more infestation on the lands outside the Big Thicket than there are on the lands where you have controlled by cutting?

Mr. ROBERTSON. I believe there is, particularly in the case of the Big Sandy Unit. The adjacent surrounding lands for 1 or 2 miles around that unit contain very young pine plantations that normally would not be infested. During the past year or two, with the big buildup of beetles in that unit, we have been getting infestations in plantations 5 to 15 years old that normally would not be infested. There is little doubt where those beetles are coming from.

Mr. SEIBERLING. That answers my question.

Mr. MacCleery, how much does it cost to pursue this vigorous cutting policy in a small wilderness area? I understand the Park Service expended $38,000 and 800 work hours pursuing a minimal cutting policy in the Big Thicket, which is an 85,000-acre area. The combined acreage of the east Texas wilderness areas are barely half that size.

How much does it cost you to carry out this policy?

Mr. MACCLEERY. I would ask Mr. Dailey to answer that. He has the figures.

Mr. DAILEY. Mr. Chairman, I do not have with me the exact, total cost of controlling the infestations within the wilderness areas.

I can provide you with the number of infestations that occurred within the five wildernesses in east Texas since their designation on October 30, 1984. For the majority of the infestations that have occurred, we have not taken any control action, but we have been monitoring them. Monitoring must be done to see whether or not a threshold of 10 infested trees in a particular infestation is reached.

Mr. SEIBERLING. Do you have figures as to how much money you have spent in these efforts?

Mr. ROBERTSON. Mr. Chairman, I think that my figures show that we spent about $3 million in Texas in 1985. That includes treatment on both National Forest System and private land. We do some cost-sharing on the private land.

Mr. SEIBERLING. You mean you pay to do it on private land?

Mr. ROBERTSON. Yes; in many cases, we share the cost, or at least part of the costs, for treating private land, not only with regard to

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southern pine beetle, but for gypsy moth and many other species as well.

Mr. SEIBERLING. I would think if you add that up over a period of time, say 30 years, we are talking about $90 million. How does that compare with the value of the old pine stands that you are trying to protect?

Mr. ROBERTSON. The estimated damage from the 1971 to 1976 outbreak was $178 million in 1976 dollars. We estimate that the damage of this outbreak, from 1982 to the present, has been over $150 million.

Mr. SEIBERLING. So the damage far exceeds the cost of control is what you are saying.

Mr. ROBERTSON. Yes; 1985 was the worst year ever in the State of Texas for southern pine beetle in terms of the number of outbreaks and the amount of damage. These outbreaks, or epidemics, occur about once every 10 years. You may have to spend a large amount of money for control, on about a 10-year cycle.

Mr. SEIBERLING. I guess we have taken enough of your time. We appreciate very much having your testimony and I think we will now proceed to panel No. 1.

Mr. ROBERTSON. I would like, Mr. Chairman, to make a closing statement.

Mr. SEIBERLING. Proceed.

Mr. ROBERTSON. The last thing we want to do is to go in and harvest timber or take some kind of action that adversely affects wilderness values. That bothers us a great deal. It is a judgment call. If we did not think, considering all the factors, that we were doing the right thing and that we had a reasonable scientific basis for what we were doing, we would not take any action.

This is a situation in which we believe that we are doing the right thing in light of what is known about the beetle and the situation.

Mr. SEIBERLING. My reaction to all this is that you have spent $500,000 on research on pheromones and biological controls, and you have spent $3 million in 1985 on cutting. It seems to me the priorities are a little bit skewed.

Why can't you reallocate some of those funds to do more research. If you can find out how to control these biologically, then you have really accomplished several objectives. What about that?

Mr. ROBERTSON. There is nothing that we would like better than to have a biological control for this insect.

Mr. SEIBERLING. What about a greater emphasis on research and less on cutting?

Mr. ROBERTSON. Yes, that is something we should look at.

Mr. SEIBERLING. What do you think, Mr. MacCleery?

Mr. MACCLEERY. I think it is a question of balancing. We have a situation that we need to deal with now, and I think there is no doubt, as has been brought out there, that there are some unanswered questions as well that we need to investigate.

Mr. SEIBERLING. Research doesn't hire as many people or keep your organizational empire as large, but it seems to me that considering the objectives of the Forest Service that it is far better to spend money on that than to hire people to go out and cut down trees in wilderness areas.

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Mr. MACCLEERY. Mr. Chairman, our objective is not to aggrandize the organization. If we could find effective ways to reduce our cost of suppression, we would certainly welcome the opportunity to reduce the $3 million to something considerably less than that.

Mr. SEIBERLING. If Gramm-Rudman takes effect and you don't have the funds or personnel, what will happen then?

Mr. MACCLEERY. Unfortunately, Gramm-Rudman cuts across research too.

Mr. SEIBERLING. I know that. Maybe we will have an opportunity to research this by not having any money to do the cutting and then we will see what happens.

Mr. MACCLEERY. That may be the case. We do have quite a bit of empirical observation and statistical analysis that does support our position for doing what we are doing.

Mr. SEIBERLING. It strikes me that you do, and I want to see what the other side has to say, so maybe we better end this dialog before we run out of time.

Mr. MACCLEERY. Thank you, Mr. Chairman.

Mr. SEIBERLING. Thank you very much.

All right, if they are still here, we would like to hear from the next panel, Dr. Frederick M. Stephen, Department of Entomology, University of Arkansas, Fayetteville, AR; Dr. Timothy Schowalter, Department of Entomology, Oregon State University, Corvallis, OR; and Dr. Jerome Jackson, Department of Biological Sciences, Mississippi State University, MS.

Dr. Stephen, do you want to start off?

[Prepared statements of Dr. Frederick M. Stephen, Dr. Timothy Schowalter, and Dr. Jerome Jackson, with attachments, may be found in the appendix.]

PANEL CONSISTING OF DR. FREDERICK M. STEPHEN, PROFESSOR, DEPARTMENT OF ENTOMOLOGY, UNIVERSITY OF ARKANSAS; DR. TIMOTHY SCHOWALTER, ASSISTANT PROFESSOR, DEPARTMENT OF ENTOMOLOGY, OREGON STATE UNIVERSITY; AND DR. JEROME JACKSON, PROFESSOR OF BIOLOGICAL SCIENCES, MISSISSIPPI STATE UNIVERSITY

Mr. STEPHEN. Thank you, Mr. Chairman.

Mr. Chairman and members of the committee, my name is Frederick M. Stephen. I have a Ph.D. from the University of California at Berkeley and I am a forest entomologist. I am currently a professor in the Department of Entomology at the University of Arkansas in Fayetteville. My professional responsibilities there include teaching and research in insect ecology, biological control, and forest entomology.

Mr. SEIBERLING. Before we begin, it would be helpful if each one of you could give us a summary of your statements. We will include the statements in the record in full. If you could give us the main points, that would be very useful to the committee.

Mr. STEPHEN. I will do my best to keep it just to the main points.

For the last 12 years, I have been actively involved in southern pine beetle research and I have published numerous articles on various aspects of southern pine beetle biology, population dynamics, and management.

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To me, the issue of whether attempts at direct control of southern pine beetle have been successful is one that has not been scientifically resolved. It may be a matter of semantics, but it is important. I think it is because, although many control methods have been shown to kill southern pine beetle individuals, there is very little evidence demonstrating control of beetle populations.

From a scientific perspective, the ability to kill beetles and the ability to control populations are not synonymous. Successful control implies the reduction of populations, and the corresponding damage level, below some acceptable threshold.

Killing beetles within specific trees or even within a specific infestation does not mean, as many people have pointed out here this morning, that damage at the stand level is also reduced.

It has also been pointed out that these insects are good flyers, they are very mobile, and they have a high reproductive potential coupled with a very short generation time. This means that their populations can grow extremely rapidly within an area. Thus, killing them in limited numbers or merely causing their dispersal to another area perhaps is not significant in reducing areawide damage.

Researchers have, during the past 10 years, developed the technology to adequately sample bark beetle populations on an areawide basis and to assess the amount of damage associated with the level of beetles. However, it remains a very expensive and difficult endeavor.

This may, I believe, explain in part why no adequate experiments on areawide evaluation of control of southern pine beetle populations have yet been published.

Let me speak just briefly about some of the options and limitations associated with direct control. I will confine my remarks to two treatments which have already been brought up, salvage and also cut-and-leave.

Salvage, which is the cutting and removal of dead and infested trees and a buffer of uninfested trees from a southern pine beetle spot is often considered as the preferred method of control. It appears that salvage can often successfully stop the growth of a particular spot, plus it can result in the use of recovered use of infested timber.

Southern pine beetles and their natural enemies may be removed from the stand with the infested trees. The beetles that are in the felled, infested trees, which are taken to mills or stored in logging decks, can still develop within those trees, however, and they may successfully emerge and disperse into other forested areas near mills or wherever.

With regard to cut-and-leave, cutting infested trees, as well as a buffer of uninfested trees at the active edge of a southern pine beetle spot, and leaving them in the forest, is utilized as a direct control strategy. In this situation, the beetles are not removed, but the process of felling infested trees and that buffer of uninfested trees is intended to disrupt the chemical communication system of the pheromone of the beetles and also eliminate the visual stimuli of vertical trees immediately adjacent to recently infested trees.

Speculation—and it is only that—suggests that this procedure works by causing the beetles to disperse. Where the beetles go

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during dispersal has not been established, nor has the amount of mortality to beetle populations been determined. However, we know that generally beetles are good flyers, with one study in a related species indicating a flight of at least 15 kilometers, or about 9 miles.

Thus, the effect of this control method on areawide populations is, at best, uncertain. Beetles may die during dispersal, they may initiate new spots, or they may locate and join other infestations. Experimentally, this is very difficult to determine. No data have been published which prove that cut-and-leave is a control strategy that can be relied upon to eliminate areawide populations of the southern pine beetle.

This brings me, perhaps, to the main reason for my wanting to make a statement today. It is not my intent to criticize the Forest Service or any other agency for utilizing salvage or cut-and-leave as a control strategy. They are under a great deal of pressure to do something to alleviate infestations. Adequate evluation of control alternatives is complex, it is expensive, and it is perhaps unlikely to be looked upon as wise use of funds.

What is most dramatically illustrated by the lack of adequate direct control methods for this important forest insect is that sufficient research on many aspects of its biology and its ecology is still lacking.

For example, we don't know why spots like Four Notch occur. It is a one-in-a-million chance; it is probably the single most large infestation that has developed in the South in the past 12 years. What is the cause of a spot like this developing? If we weren't here, what would stop it? Obviously, something would through time, without man's intervention.

During the past 12 years there has been a south-wide research effort, directed by Dr. Thatcher. Many of us have been involved in this, and we have attempted to develop management systems for this pest. We have developed massive amounts of information; we are using much of that information.

Funds for research on the southern pine beetle, however, have been drastically cut recently, and currently there is no organized program to develop integrated forest pest management systems for this beetle.

There has been good cooperation between the Forest Service and university scientists, but long-term studies are needed on basic issues of beetle, tree and stand dynamics, which can ultimately lead to successful management.

In regard to issues of wilderness and southern pine beetle control, as has been stressed, and I know will be stressed more, the southern pine beetle is a natural component of the southern pine forest ecosystem. The ecosystem has evolved over millions of years with its native insects and pine hosts, and with the other animals and plants that are found in the southern pine hardwood forest.

The southern pine beetle is one of the reasons why natural, unmanaged forests become uneven-aged mixtures of pine and hardwood. Proper management of the southern pine beetle population requires an understanding of the forest ecosystem and of why the insect may cause so much damage in forests that are primarily monocultures of pure, even-aged, overmature pine.

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As long as forests of this type abound in the South, the southern pine beetle will always be a threat. Proper management of the southern pine beetle requires, in my estimation, a silvicultural viewpoint. Short-term approaches to controlling populations will most likely only provide short-term solutions or may fail altogether.

Even if direct control techniques are shown to reduce damage in a specific infestation, it is almost certain that the southern pine beetle will continue to be a problem in the area unless the stand conditions that led to the outbreak are changed.

In my opinion, there appear to be two alternatives. One, is to intensively manage a wilderness area for a variety of uses. You maintain forest structure and composition in such a manner that stand hazard is low and southern pine beetle infestations are unlikely.

The second alternative is to leave the southern pine beetle alone in the wilderness area. It will, through time, kill susceptible pines existing in dense or overmature stands, eventually influencing forest structure and composition so that the likelihood of large outbreaks is minimized.

I realize that the complexity of issues surrounding the philosophy of wilderness areas is sufficiently great as to cloud any simple statement on what should, or should not be done about forest protection. I do believe, however, that short-term solutions to problems like the southern pine beetle in wilderness areas are liable to raise more problems than they solve.

This concludes my statement. Thank you very much for the invitation to comment.

Mr. SEIBERLING. Thank you for a very excellent statement.

Mr. Schowalter.

Mr. SCHOWALTER. Thank you, Mr. Chairman.

I am Dr. Tim Schowalter, currently assistant professor of entomology at Oregon State University. I am responsible there for research and teaching in the areas of forest entomology and ecosystem ecology.

I was trained as an entomologist and ecosystem ecologist at the University of Georgia. I subsequently conducted forest entomology research on population dynamics of the southern pine beetle while on the faculty at Texas A&M University.

My studies while at Texas A&M University indicated that the southern pine beetle is very sensitive to tree spacing at low beetle population levels. Low population levels being those less than 100,000 beetles capable of killing less than one tree per day.

At higher population levels, over 100,000 beetles capable of killing more than one tree a day, the number of attractive centers appears to be sufficient to allow these beetles to cross fairly broad, cleared areas so that the effectiveness of thinning as a control may be somewhat reduced at high population levels.

Unfortunately, the critical experiments using control plots to assess southern pine beetle activity with and without thinning treatments have not been conducted. Therefore, they have not demonstrated the efficacy of thinning or clearing buffer strips as the southern pine beetle treatments to the satisfaction of the scientific community.

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The separate question of whether these techniques should be applied in wilderness or potential wilderness areas depends on what we expect of designated wilderness areas. It requires an understanding of the normal processes and mechanisms responsible for community development.

Change in natural communities is inevitable. The how and when of change is determined by natural fluctuations in environmental conditions such as temperature and precipitation. It is determined by the timing and severity of natural disturbances or artificial disturbances in many cases. It is determined by nutrient imbalances resulting from changes in nutrient availability relative to plant growth requirements, and it depends on the pool of interacting species within the area or available from surrounding areas.

The importance of natural disturbance, especially in southern pine forests cannot be underestimated. The pine forests which apparently predominated across the South at the time of European settlement persisted only because of the periodic, regular fires which relieved them of hardwood competition and provided the bare mineral soil conditions necessary for pine regeneration.

Pine seedlings cannot persist under a canopy. Therefore, under conditions where fire is delayed, either naturally or artificially, this system will, eventually, be altered to a pure hardwood forest.

Clearly, there are two issues involved in whether we are going to manage forests to protect the pines or to control the southern pine beetle. If, on the one hand, our expectation of wilderness is that it is to persist with the particular conditions for which it was designated wilderness indefinitely, then clearly we need to go in and introduce whatever management is necessary to try and protect that forest condition.

Unfortunately, we don't know the ultimate consequences of introduced controls. For instance, branch breakage and wind throw are common consequences of small patch cutting in continuous forests. The edge trees are suddenly exposed to wind and storm damage to which they were not previously exposed, and severe damage to those trees often occurs.

These conditions increase the susceptibility of those trees either to attacks by the southern pine beetle or to other insects which may exploit those conditions of increased resource availability.

The big problem here is that we don't know what the ultimate consequences are of introducing any management practice into an area designated for protection. If, on the other hand, we intend to protect the integrity of these ecosystems designated for wilderness, then it is imperative that we recognize the natural processes and mechanisms through which these systems are developed. That means acknowledging factors such as fire and the southern pine beetle which are critical to the normal development of these forests. If this is the case, then we also need to designate large enough areas protected by adequate, unmanaged buffers so that the stable mosaic of young, middle-growth or old-growth stands, mixed-species composition and so on is available so that particular community types are constantly replenished as those natural processes and mechanisms alter others.

I might add that I have a continuing interest in this particular issue beyond its immediate application in east Texas because this is

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a problem that is inevitable in all of the small, patch-sized wildernesses that we have designated around the country.

In Oregon, I have been asked to advise on the feasibility of controlling Douglas-fir beetle in areas of wind throw on roadless areas, and we have the imminent threat of having to follow the State guidelines for irradication for gypsy moth in wilderness areas if this insect becomes established in Oregon.

Thank you, Mr. Chairman.

Mr. SEIBERLING. Thank you for some very interesting testimony. Dr. Jackson.

Mr. JACKSON. Mr. Chairman, my name is Jerome Jackson. I am professor of biological sciences at Mississippi State University. I am also a director of the U.S. Section of the International Council for Bird Preservation, and liaison between the Wilson Ornithological Society and the Fish and Wildlife Service Office of Endangered Species. I am also editor of the Journal of Bird Conservation.

The emphasis of my research for the past 16 years has been the endangered red cockaded woodpecker. This reseach has resulted in over 30 publications on this species; many of them dealing with management of the species.

I served as team leader for the red cockaded woodpecker endangered species recovery team of the U.S. Fish and Wildlife Service for 8 years, and I have studied the red cockaded woodpecker throughout its range, including the Texas National Forest.

I am just briefly going to summarize the major points of my statement. With its proposal to protect red cockaded woodpecker colonies from southern pine beetles by cutting buffer zones around them, the Forest Service is taking a crisis management approach rather than a crisis prevention approach.

Even with that, I disagree with the concept of cutting the buffer zones and feel that these can have a negative impact on the woodpecker rather than a positive one.

There are major flaws in reasoning associated with the buffer zone plan. The first is the implied assumption that any pine beetle attack will destroy red cockaded woodpecker colonies. Entomological research has demonstrated that the average southern pine beetle infestation is less than an acre. Pines can and do survive near other trees that are being killed by southern pine beetles. None, however, survive if they are being clear cut.

Cutting of buffer zones can negatively impact the red cockaded woodpecker by reducing nearby food resources, by eliminating potential cavity trees, by increasing the risk of southern pine beetle infestation as a result of injury to trees adjacent to those being cut, by increasing the risk of wind damage to cavity trees, by making birds more vulnerable to predators as they fly across newly created open areas, and possibly by upsetting normal behavior as a result of the cutting activities.

In addition to these effects or potential effects on red cockaded woodpeckers, the cutting of beetle-killed trees destroys potential nest sites for other species of woodpeckers, nut hatches, bluebirds, flycatchers, and many other species of birds which are predators of the southern pine beetle.

Southern pine beetles have decimated some forests in Louisiana and Texas, and there is potential for other such epidemics. Would

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cutting a buffer zone around red cockaded woodpeckers colonies in such areas save those colonies? It might save some cavity trees, but in my opinion it would not save the birds in the event of a catastrophic infestation.

The plan to clear buffer zones implies that if one saves the cavity trees, the birds will survive. They are not likely to survive if the surrounding forest is killed. The large home ranges of red cockaded woodpeckers, which average about 200 acres per group, are not incidental to the welfare of the birds. They are needed to provide an adequate food supply. Since in excess of 90 percent of the feeding of red cockaded woodpeckers is done on live pines, the birds cannot persist for long if only their colony site remains.

It is my opinion that the Forest Service should manage southern wilderness areas that would have naturally supported southern pines by ensuring that either natural or man-caused fires burn the forest at a frequency that would have occurred before arrival of European man.

With a natural fire regime reinstated, the forests of the wilderness areas would revert to their orginal state; suitable habitat would be provided for the red cockaded woodpecker and other components of the southern pine forest ecosystem, and southern pine beetle populations would be naturally controlled.

Until such a fire regime can be reinstated, some measures may be appropriate to protect red cockaded woodpecker colonies. Such measures, however, do not need to include cutting of buffer zones. Attractant and repellant chemicals are known which could be used to attract southern pine beetles to traps and to keep them away from red cockaded woodpecker colony sites, and these chemicals only affect the beetles and would not otherwise disturb the wilderness ecosystem.

Appended to my statement is a manuscript which is currently in press in a symposium that was cosponsored by the U.S. Forest Service and the Wilderness Society. This manuscript is titled, "The Effects of Wilderness on the Endangered Red-cockaded Woodpecker," and it is coauthored by Dr. Betty Jackson from Mississippi State University and Dr. Richard N. Connor, who is a Forest Service expert on red cockaded woodpeckers who works for the Forest Service in Texas.

My verbal statement summarizes that manuscript. The manuscript goes into considerable detail in talking about the significance and importance of fire to southern pine forest ecosystems and to the red cockaded woodpecker in particular.

Thank you, Mr. Chairman.

Mr. SEIBERLING. Thank you for some very interesting testimony.

Dr. Stephen, you heard Dr. Billings say that if you cut buffer zones, then it is likely that the number of beetles that will be able to move to areas in sufficient numbers to produce the pheromones—I am not sure how the mechanism works—will be small enough so that they are not likely to produce an infestation.

What is your comment on that? I haven't correctly summarized it, but you heard what he said.

Mr. STEPHEN. Let me see if I am understanding what you are asking.

You are asking whether or not it is neccesary to cut a buffer?

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Mr. SEIBERLING. Dr. Billings said that if you cut buffer zones you will minimize the spread of the beetles because they are not likely, even if they do fly to the adjoining forest, to be in conditions where they are producing pheromones for some reason or another.

Mr. STEPHEN. I would agree with the idea that cutting a buffer zone would probably be more effective in stopping the spread of a particular spot or the growth of a particular infestation. Cutting the buffer zone would assist in removing trees immediately adjacent and stopping the production of pheromone in that specific spot.

I would believe, however, that this would enhance dispersal from the area, and where those insects are going to go is unknown.

Mr. SEIBERLING. In other words, while it will prevent them spreading out from that area as an active colony, it doesn't prevent the beetles from flying on to somewhere else. Is that what you are saying?

Mr. STEPHEN. No. It should cause some increased mortality by opening up the stand by exposing the beetles that are lying in the trees that are on the ground, the solar radiation should kill some of those beetles. But in terms of their ability to disperse, no, in no way has their long-range ability for dispersal been affected.

Mr. SEIBERLING. I noted that you pointed out the beetles could fly up to 15 miles?

Mr. STEPHEN. Kilometers, but 9 miles. This was a related species studied in California.

Mr. SEIBERLING. Is that true of the southern pine bark beetle? Can they fly that far?

Mr. STEPHEN. They are strong fliers; there have been no studies that I am aware of that would suggest just how far they can fly. We have some experience in Arkansas with new infestations being located many miles from the nearest known adjacent infestation which would suggest that, yes, indeed, they do have very long-range dispersal capabilities.

Mr. SEIBERLING. You also pointed out that the cut-and-remove policy can result in beetles being dispersed over a wide area by falling out of the logs as they are moved.

Mr. STEPHEN. I wouldn't suggest that they would fall out of the logs, but they can develop in cut trees. If trees are taken to mills and not processed before the beetles have completed their emergence, then there is no evidence to suggest that they could not emerge from the trees wherever they are taken.

Mr. SEIBERLING. In other words, it can help disperse the beetles?

Mr. STEPHEN. It is conceivable.

Mr. SEIBERLING. All of you indicate that the best way to handle this problem in wilderness areas is to leave it alone. Yet, the Forest Service is in a dilemma. I presume they are under great pressure from surrounding property owners, timberland owners, to control the spread of beetles onto their property.

You do concede, as I read it, that the cutting of spots and removal of them does reduce the spread at least where it is a spread from one single point outward. Is that true?

Mr. STEPHEN. I would say that both cut-and-leave and salvage have been demonstrated to have the potential for stopping the

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growth of a particular spot. I think that that has been demonstrated.

Mr. SEIBERLING. Well, doesn't it reduce the total number of beetle infestations in the larger areas surrounding the wilderness?

Mr. STEPHEN. I think that becomes a much more complicated issue and is more subject to experimentation. Those experiments are very difficult and expensive to do and I don't think there has been adequate research in that area.

Mr. SEIBERLING. So you don't agree with Dr. Billings in the Texas Forest Service that this shows a reduction in total number of infestations?

Mr. STEPHEN. In terms of total number of infestations, I am not sure. What I am saying is that cutting trees may not be effective in terms of the total size of the beetle population that exists in the area as a function of the number of trees killed through time on an areawide basis.

Mr. SEIBERLING. I guess the number of infestations shouldn't be the measure. The measure should be how many trees are killed?

Mr. STEPHEN. That is correct.

Mr. SEIBERLING. You are saying that there is no proof that cutting does reduce the number of trees killed in the area as a whole.

Mr. STEPHEN. In terms of scientifically designed experiments where you have a treatment and a control, I am not aware of that.

Mr. SEIBERLING. Do all of you have the same view?

Mr. JACKSON. Yes, Mr. Chairman.

Mr. SEIBERLING. Now, is it possible that these wilderness areas in east Texas are so small that leaving them alone isn't a solution because, for example, if you had a beetle infestation in an entire area, or a fire or hurricane that wiped out all of the pines in one wilderness area, then wouldn't that in effect produce a monoculture again?

In other words, wouldn't it be a repetition? Can you leave them alone since the surrounding ecosystem is not being managed the same way as the wilderness area?

Mr. SCHOWALTER. I will address that one.

Mr. Chairman, the small patches are essentially communities that have been isolated for preservation within a managed matrix. They are highly vulnerable to various factors introduced from outside as well as to natural disturbances simply because of their small size.

Fires and southern pine beetle activity on a premanagement basis would probably have affected areas that we would see as relatively large compared to our wilderness acreage, but would be relatively small on a whole forest basis. When we dissect these communities out of the forest, they are no longer ecologically viable.

Mr. SEIBERLING. Are we kidding ourselves to think that we can preserve the wilderness areas?

Mr. SCHOWALTER. They would not be preserved in their present form. I think the Four Notch example is a case of what is inevitable and probably most wilderness areas. Most small patches, communities that have been preserved for their unique qualities or as endangered species habitat, perhaps not in our lifetimes but inevitably will change as a result of these various factors that influence changes in natural communities.

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Mr. SEIBERLING. Do you still think we should leave them alone and let nature take its course?

Mr. SCHOWALTER. I think something like the Four Notch community could be a good scientific basis for evaluating what happens following a southern pine beetle outbreak.

Again, the issues here are not black and white; it depends on what is intended in wilderness designation. If we are intending to preserve a particular community type for endangered species habitat or for the gene pools represented whatever, then it is encumbent upon us to preserve a large enough area so that the stable mosaic of communities that are necessary for ecosystem integrity be maintained.

It is unlikely that we could preserve these particular communities such as Four Notch in their present state indefinitely.

Mr. SEIBERLING. So you would advocate putting Four Notch into a wilderness area?

Mr. SCHOWALTER. I would.

Mr. SEIBERLING. You would.

You say you would or would not?

Mr. SCHOWALTER. I would. I think that it has useful scientific value to it in the sense of looking at the future of a site that has undergone a natural process.

Mr. SEIBERLING. What about the areas we have already designated wilderness in east Texas? Was that a vain thing?

Mr. SCHOWALTER. I am sorry; I am not sure I understand your question.

Mr. SEIBERLING. Do we do a vain thing to designate the east Texas wilderness areas?

Mr. SCHOWALTER. Again, I think that the fact that only small patches of particular community types, these fairly old-growth pine forests have been designated for wilderness status is insufficient. These small communities isolated within a managed mosaic have no ecological viability. They cannot persist in their present state indefinitely. They will undergo changes. So if we expect them to remain in an old-growth status, it is an unrealistic expectation.

If, on the other hand, we intend to maintain the natural processes that are critical to the structure of these systems, to the natural age distribution or species mix of these stands, then yes, those are valid wilderness areas to be set aside and left to cycle under those natural conditions.

Mr. SEIBERLING. There were some beautiful cypress trees and oaks and beech trees in many of those areas, and that is what attracted the people who like wilderness, who like to use it. The thought was that if we set them aside as wilderness, the people can continue to have the experience of seeing that type of forest.

Are you saying that that cannot continue?

Mr. SCHOWALTER. If that is the only objective, that cannot continue.

Mr. SEIBERLING. What will happen if nothing is done?

Mr. SCHOWALTER. There are ice storms, hurricanes, fires, and the southern pine beetle. There are a number of factors that are responsible for the natural turnover.

Mr. SEIBERLING. But then new vegetation will grow and remain wild.

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Mr. SCHOWALTER. Yes. I think a natural equilibrium could be reestablished in those sites if the area is large enough and they are protected from outside.

Mr. SEIBERLING. How large an area is needed?

Mr. SCHOWALTER. A particular area I don't think I could state. I think it would have to represent the natural variation in the vegetation of the area. It would have to include a combination of different aged stands, young growth, midgrowth, old growth, and a representation of the natural community mixes of the area, so that as one community is transformed into another, one of the other communities may be transformed into the one of interest.

Mr. SEIBERLING. All right.

Mr. JACKSON. I think there are two points that are being misunderstood. One is regarding the role of fire in this ecosystem and the other is the condition of what has been designated wilderness.

Let me take the last point first. I don't believe that what has been designated wilderness is really in the primeval condition. I don't think anyone else here does either. It is not what would have been there naturally.

Mr. SEIBERLING. We didn't think so either. But we were just trying to preserve an area that has a natural quality to it.

Mr. JACKSON. Yes. But it has been affected by man and the reason that it is what it is today is because of management. If the concept of wilderness is to preserve an area in its natural state, then all components of the ecosystem must be allowed to play their natural roles, and fire is among those components.

Before the arrival of European man, the pine forests of the South were burned by lightning-started fires at about 3- to 5-year intervals. Normally, I think I caught in one of your statements that you thought of fire as a destructive force, and most people do think of fire as a destructive force. But in the case of the southern pine forest ecosystems, fire plays an essential and a very positive role.

Southern pines tolerate fire, but are intolerant of shade, as has been pointed out earlier. Many hardwood trees, on the other hand, tolerate shade but not fire. Before the arrival of European man, a lightning-started fire might have burned for miles, keeping the pine forest open and eliminating hardwoods which would otherwise kill young pines by shading them. Someone else alluded to that earlier by the descriptions of the early explorers who could see for miles through the open pine woods. That is what it was naturally like as a result of the natural, lightning-started fires and sometimes Indian-started fires that occurred in the area.

Mr. SEIBERLING. This is savannah-like?

Mr. JACKSON. Yes. It would have been an open pine stand, much less susceptible to pine beetles as a result of it being an open pine stand. This doesn't mean that the whole area was open pines. The low areas would have been hardwoods. It would have been a mix of species. There would have been a mix of age classes of trees in the area.

Construction of roads and clearing of lands limited the extent to which natural fires could burn. The wilderness areas that have been established are so small that natural fires still cannot burn with the frequency that they would have burned naturally so that whatever goes up and whatever equilibrium is reached in those wil-

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derness areas today, unless fire is added back to the ecosystem with the frequency with which it would have occurred naturally, it is going to be an unnatural wilderness. It is not going to be what would have been there naturally.

Mr. SEIBERLING. Would you recommend controlled burning in some of these areas?

Mr. JACKSON. I recommend the addition of fire to the ecosystem if it is needed to the extent that fire would have occurred there naturally. The manuscript that is appended by my statement has at the back of it three maps which show the incidence of lightning in the United States on an annual basis and at different seasons.

It shows very clearly that lightning is dramatically more prevalent in the Southeastern United States than it is anywhere else in North America and, indeed, almost higher than anywhere else in the world. Lightning is a very essential component of the southern pine ecosystems.

Someone was speaking of what the climax forest would be in Texas and they mentioned hardwoods. What they failed to distinguish is that there is such a thing as a fire climax. The southern pine forest ecosystem is a fire climax ecosystem. It means that it is one that is held at that stage by fire.

If fire is eliminated from an ecosystem, as has been done in the wilderness areas and in some other areas in Texas, then the final climax will be hardwoods, but that is not a natural climax; it is a climax without the natural component of fire.

Fire plays a number of roles in addition to controlling the hardwoods and keeping an open pine forest ecosystem that would be less susceptible to southern pine beetles. It also thins the young pines, helping to keep it open, and that is the habitat that is favored by the red cockaded woodpeckers. They cannot tolerate the very dense stands of pines that are in many of the wilderness areas today as a result of the control of fire. That is why the red cockaded woodpecker populations are so low there. They require the open pines that would have occurred if fire had been allowed to be there.

The lack of an adequate frequency of fire on southern national forests has resulted in an overcrowding of pines and an invasion of hardwoods, and this overcrowding stresses the trees; it makes them more vulnerable to southern pine beetles, and because of the closer spacing, the beetles can spread more rapidly.

Mr. SEIBERLING. Thank you very much.

I take it you wouldn't agree with the district court decision then to allow the Forest Service to cut buffers to protect the woodpeckers?

Mr. JACKSON. No, sir. I think there are occasions when it may be important to cut individual trees to protect the red cockaded woodpecker colony. I just recommended the other day in the Beinville National Forest that they do go ahead and cut a tree that happened to be within a red cockaded woodpecker colony.

I think that in a wilderness area in particular there are other alternatives. I think the first approach should be avoiding the crisis rather than managing the crisis.

Mr. SEIBERLING. I thought that was a very good point that you made. I could see the Forest Service has a problem; it is a political problem in part because of the pressure they are under from the

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owners of surrounding lands to try to curb the beetles. All of you, I think, would agree that the priorities ought to be more toward preventive research rather than just dealing with individual infestations; am I correct in that?

Mr. JACKSON. I think preventive research and also more research in the area of pheromones has already been suggested

Mr. SEIBERLING. Are there any other areas besides pheromones that look promising?

Mr. SCHOWALTER. I would note again the importance of controlled burning as a means of removing the hardwood understory, alleviating hardwood competition with the pines and reducing their susceptibility to the southern pine beetle.

I think in this context that if we sacrifice the natural integrity of the system, including the southern pine beetle's role in naturally recycling these forests and maintaining their uneven age structure for economic concerns, then we have wasted our time considering these for wilderness.

Mr. STEPHEN. I would also add, if I may, that even though we have done years of study in terms of understanding the natural controlling factors which, either when they are not working allow spots of large size and epidemics to develop or those factors that under natural situations work to control these infestations, there is a need for additional research.

As has been pointed out, a very small percentage of southern pine beetle spots grow to be a problem. We need to have an understanding of the natural enemies and other factors which involve tree resistance and susceptibility and the beetle's interrelationship with trees. We need to be able to work much more in those areas to understand what happens at low-level situations and to really gain a greater understanding of the problem.

Mr. SEIBERLING. Thank you.

I really appreciate your testimony and the fact that you have come all this way to give us the benefit of your knowledge. I wish we had more time. It is a very interesting subject, but I think we better go on to panel No. 2, which consists of Dr. David L. Wood, Department of Entomology, University of California at Berkeley; Dr. William E. Waters, Department of Forestry and Resource Management; and Dr. Kenneth Lindahl, Department of Entomology. They are all from the same university.

Dr. Wood.

[Prepared statements of Dr. David L. Wood, Dr. William E. Waters, and Kenneth Lindahl may be found in the appendix.]

PANEL FROM THE UNIVERSITY OF CALIFORNIA CONSISTING OF DR. DAVID L. WOOD, DEPARTMENT OF ENTOMOLOGY; DR. WILLIAM E. WATERS, DEPARTMENT OF FORESTRY AND RESOURCE MANAGEMENT; AND DR. KENNETH LINDAHL, DEPARTMENT OF ENTOMOLOGY

Mr. WOOD. Thank you, Mr. Chairman.

My name is David Wood. I am a professor of entomology and chairman of the Department of Entomological Sciences at the University of California at Berkeley.

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Mr. SEIBERLING. I will ask each of you if you can give us the high points of your testimony, and, without objection, we will include the full statements in the record.

Mr. WOOD. Would you like to hear my credentials, or shall I just go ahead?

Mr. SEIBERLING. We will stipulate that you are eminently qualified.

Mr. WOOD. Thank you.

I should mention one part of my credentials that I am proud of, and that is that I was a participant in the expanded Southern Pine Beetle Research and Development Program as a member of the technical committee in its first 5 years of life. We discussed this cut-and-leave at that time when Ron Billings' predecessor was on the committee.

The following is my assessment of the appropriateness of the cut-and-leave method to control the southern pine beetle. I would like to quote from a chapter which I coauthored with four other scientists. The chapter is entitled "Treatment, Tactics and Strategies," and it is published in the book titled, "Integrated Pest Management in Pine Bark Beetle Ecosystems," edited by Waters, Stark and Wood, published in 1985.

I will skip over the next page except the last paragraph.

Treatments such as cut-and-leave which are aimed at bark beetles while they are present in the tree, or while they are attacking new trees in the immediate vicinity of infested trees, are the most difficult to execute.

The reasons for this are, one, infested trees must be detected prior to the emergence of the parent and new brood adults. Aerial surveys detect trees with needles that have changed color from the normal green to yellow and red. Beetles have emerged from trees that have turned yellow in color. Certainly, parent adults will have emerged while the foliage is green. Thus, trees with normal green foliage may be infested.

Two, species of bark beetles that produce many generations each year require frequent aerial surveys to detect recently infested trees. Therefore, treatments aimed at populations of beetles in trees must be conducted rapidly in order to inflict maximum mortality before the beetles leave the trees.

Three, the logistics of visiting groups of infested trees in a timely manner and over a sufficiently large enough area means that only a small proportion of the beetles will be killed through direct control treatments such as cut-and-leave.

Taking into account these serious biological and operational constraints, I cannot support the use of cut-and-leave as a treatment tactic for use against the southern pine beetle. Efficacy of this method has not been established experimentally. In order to accomplish this, evaluation of tree mortality in and near groups of treated trees—so-called spot growth—and in areas between groups of infested trees—called spot initiation—is required. Thus, it is not sufficient to judge efficacy of the treatment by evaluating spot growth alone. One can speculate that one of the outcomes of treating spots by the cut-and-leave method is an increase in the number of new spots at some distance from the treated spot.

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Since to my knowledge there are no estimates of mortality of bark beetles caused by this treatment method, there is no scientific basis for the treatment. Furthermore, to my knowledge no replicated study has been conducted where tree mortality in treated areas before, during and after the treatment was compared to tree mortality in areas where no treatment was applied.

Thus, the cut-and-leave treatment described in the publication authored by Swain and Remion entitled, "Director Control Methods for the Southern Pine Beetle," U.S. Department of Agriculture Handbook No. 575, published in 1981, is not supported by evidence from controlled experiments.

Swain and Remion further state that "* * * the cut-and-leave method was first recommended by the Texas Forest Service for controlling small spots—10 to 50 infested trees—that could not be salvaged. This technique involves felling infested trees and a buffer of uninfested trees and leaving them in the woods. The treatment disrupts spot growth and causes emerging adults to disperse into the surrounding forest."

Apart from the fact that we do not know what happens to the beetles under these treatment conditions, I have serious doubts about employing such a treatment to prevent the spread of beetles to adjacent forested areas, whether they be wilderness or private ownerships.

As we state in our 1985 chapter, experiments with treatments also have had a major deficiency. Lack of replication. Without sufficient replication, one cannot separate treatment effects from the effects caused by natural control agents, nor can the relative effectiveness of different treatment combinations be evaluated.

Treatments generally have not been applied and evaluated over a sufficiently large area to account for the movement of beetles into and out of the treatment area. It is insufficient to evaluate efficacy of a pest population treatment from treatment only of a few trees or groups of trees.

I would like to quote from two statements that were made earlier this morning if I may. Mr. MacCleery stated on page 2 at the bottom, "* * * that salvage removal of infested trees is the preferred and the most effective control technique."

I do not believe that salvage removal has been experimentally proven to be efficacious. He goes on to say, at the bottom of the same page, "* * * in recent years cutting and leaving the infested trees in the forest has been used in situations where salvage was not practical. Although this technique does not physically remove the beetles from the forest, our data indicate that significantly greater than normal beetle mortality occurs after beetle emergence from the trees. Surviving beetles are also less likely to successfully attack nearby healthy trees."

My question here is where are the experiments that prove that greater than normal beetle mortality occurs after beetle emergence from these trees. Dr. Billings states on page 4 of his statement, at the top,

> The principle direct control tactics currently used to treat southern pine beetle infestations are cut and remove, salvage, and cut and leave. Cut-and-remove has been proven from extensive experience, including 20 consecutive years in Texas, to

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be a valid and effective means to control individual southern pine beetle infestations.

I contend that this extensive experience in Texas does not constitute scientific proof of efficacy of these treatments. What does constitute scientific proof of efficacy will become clear after my colleagues to my right give their testimony.

Thank you, Mr. Chairman.

Mr. SEIBERLING. Dr. Waters.

Mr. WATERS. Mr. Chairman, my name is William Waters. I am professor of entomology and forestry at the University of California at Berkeley. My curriculum vitae is attached to my statement, so my qualifications, et cetera, perhaps are best described there.

I would like to mention, however, that I worked for the U.S. Forest Service for 28 years in various research positions dealing with forest insects, including 5 years as Chief of Forest Insect Research in the Washington office. During that latter stint, I participated in writing portions of the Forest Service manual that defines the responsibilities of research and pest management personnel in developing effective means of managing destructive pests.

I also participated in the development of plans for the expanded research and development programs funded by the USDA on the southern pine beetle and gypsy moth and Douglas-fir tusk moth.

I wish to address the issue of the scientific basis for use of tree harvesting as a means of controlling southern pine beetle infestations by first outlining the kind of research needed to develop sound methodology for direct control of any destructive forest insect, and then commenting on certain voids and shortcomings in this scientific process as it applies to the southern pine beetle.

There are three steps or phases in the process. First, are laboratory studies and experiments. This includes studies of certain aspects of the basic biology and behavior of the insect that can be carried out in a laboratory setting. It also includes experimentation with chemicals or other treatment possibilities.

Research of this sort, spanning 50 years or more, has provided much information on the genetics, physiology, pathology, and behavioral mechanisms of the southern pine beetle that are pertinent for the development of direct control treatments.

The second phase includes field studies and experiments. This phase includes studies of all aspects of the biology, behavior and population dynamics of the insect under natural forest conditions. Life history, natural enemies, interaction with host trees, and dispersal, are examples.

This information is the basic ingredient in developing control strategies and tactics. It provides a foundation and framework for the field testing of alternative treatments and, importantly, for the development of sound criteria for evaluating treatment effectiveness.

With respect to the southern pine beetle, research at this level, particularly in the last 15 years, has provided a rich background of information. There is one notable void, however, that relates directly to the rationale for controlling southern pine beetle infestations on a spot-by-spot basis to prevent tree mortality on adjoining lands, and the question of actual efficacy of the tree harvesting techniques presently used by the Forest Service in this situation.

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Various speakers, including Forest Service people have mentioned this particular item. It has to do with information that we lack on the dispersal behavior and capabilities of the beetle.

We know that time of year, weather, forest stand conditions, terrain, beetle population density and other factors all affect the direction and distance of beetle flight. We do not know how all of these factors interact in particular situations throughout the insect's range. Thus, our ability to predict the rate of enlargement of individual spot infestations and the occurrence of new spots at any given time and location is very limited.

This means, also, that the use of a particular harvesting technique, including the cutting of a buffer strip of uninfested trees of any designated length—100 feet or less, for example, as recommended by Swain and Remion in the publication mentioned by Dr. Wood—any one harvesting technique such as that is not likely to be effective in all situations.

For any method of treatment for direct control of a pest insect, there are a number of variables that determine treatment effectiveness. Whatever the method of treatment, carefully designed field experiments are needed to find out what is the most effective treatment combination over a representative range of pest and forest conditions.

Being the best treatment is not enough. Field experiments are also needed to determine what, if any, treatment combinations meet a specified level of satisfactory performance.

With tree harvesting strategies for direct control of southern pine beetle and spot infestations, the cut-and-leave method for example, the treatment variables include timing, condition of trees to be cut, and size of buffer strip, each with several levels of treatment intensity. Actually, some other variables have been mentioned in previous discussions.

Then there are site, stand and beetle population conditions to be accounted for. That is land form, stand age and density, spot size and beetle population level. The effect of these variables on efficacy of treatment must be included in any analysis in order to determine just how reliable and consistent this method of control really is. Putting it another way, under just what conditions will the cut-and-leave method meet the standard of performance specified as acceptable.

The magnitude of the task of designing and conducting a field experiment that can adequately measure the effects of treatment and critical environmental variables on a realistically comprehensive scale is compounded by the need for replication of all treatment combinations. Depending on the number of treatment combinations, environmental variables and replications, the size of an experiment can quickly become quite large.

For example, suppose we design a simple cut and leave experiment involving the harvesting of all infested trees in three size classes of spots at three different times of the year and include the cutting of infested trees and two widths of buffer zone. This means we would have 3 times 2 equals 18 treatment combinations, which would require 18 individual spot infestations for a single representation or a replicate of each.

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In order to analyze the data from this experiment statistically, we need at least 2 replicates of each treatment or 36 individual infestations. Given the number of other factors that are not included in the design of this experiment, we probably would be well advised to have three, four or five replicates of the treatment combinations that are included in order to have some assurance that we can detect any significant differences in effectiveness among them. This would require 54, 72, or 90 individual infestations in the experiment.

To my knowledge, no field experiment of this magnitude, as basically simple as it is, has yet been conducted for the cut-and-leave method for direct control of the southern pine beetle. It sounds discouraging, I know.

Many field trials of this method, as well as the salvage method, have been conducted in east Texas and elsewhere in the South at different times of year and under a variety of infestation conditions, essentially without any experimental design. The results have been evaluated in terms both of spot enlargement, and spot proliferation, and methods of sampling and monitoring infestations before and after treatment have varied. In many cases of apparent success, it hasn't been really clear whether this was due to the treatment or to the natural subsidence of beetle activity due to weather or other factors.

This conglomerate of shotgun testing has resulted in a wide range of views as to the efficacy of these harvesting techniques, and in my opinion, has not provided scientifically sound evidence for their operational use.

There is a third phase; pilot test. This phase includes the field testing of selected treatments under operational conditions. It is an essential step that is required to confirm the efficacy of a particular treatment or to compare the efficacy of two or very few treatments, when carried out in a practical way on an operational scale.

The pilot test is the place also to work out details of field procedure to be followed in practice. They have to be carefully designed and monitored as carefully as field experiments. They also have to be adequately replicated.

The basic question to be answered by pilot tests is does the treatment or treatments achieve its purpose? That is, does it meet the specified level of satisfactory performance in terms of both pest population suppression and reduction in tree mortality.

The added requirement of pilot tests, which I don't believe has been mentioned thus far, is that they be monitored for a sufficiently long period to determine the duration of effectiveness of the treatments. This bit of information is needed to estimate cost effectiveness and provide the basis for future planning.

Much of the field testing of harvesting techniques to control the southern pine beetle which we have heard described so far can be characterized as a mix of trial and error experimentation and pilot testing. Expectations and specifications of what constitutes satisfactory performance have varied. The results have varied with insufficient evidence generally to fully explain either success or failure.

In my opinion, this critical phase of research and development for direct control of the southern pine beetle by harvesting tech-

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niques has not been conceived nor conducted adequately to provide answers to the basic operational questions.

In particular, we do not yet know what effect the treatment of spot infestations has on beetle dispersal and attack behavior on an areawide basis.

To sum up, because of the volatile population dynamics of the southern pine beetle, uncertainties as to the reliability and consistency of effectiveness of spot treatments and lack of evidence of areawide effectiveness, the operational use of the salvage removal and cut-and-leave techniques to either control this insect in a given area or to protect other areas not presently infested cannot be justified scientifically.

Mr. SEIBERLING. Thank you.

Mr. Lindahl.

Mr. LINDAHL. Thank you, Mr. Chairman.

My name is Kenneth Lindahl, Jr.

Mr. SEIBERLING. Can you give us a summary of your paper? We shall put it in the record in full.

Mr. LINDAHL. Mr. Chairman, I am a candidate for the Ph.D. degree in the biostatistics program at the University of California at Berkeley. I am familiar with the issues of field experimentation with bark beetles through 10 years of collaboration with David Wood.

I am currently working on a Ph.D. dissertation which involves the development of statistical techniques for evaluating the effects of a large-scale trapping program to control the western pine beetle. I am familiar with the published papers describing research funded by the expanded Southern Pine Beetle Research and Development Program.

I would like to address the experimental design issues relevant to a pilot test to show the efficacy of timber harvesting as a method to control the southern pine beetle. The issues are, first, issues involved in choosing treatments to be compared; the experimental units to be used and the observations to be made, that is, the specific quantities to be measured.

Second, issues involved in assigning treatments to experimental units in deciding how many units should be used, that is, sample size. Pilot tests usually consist of a single experimental treatment selected and fine tuned during the preceding field experimentation phase of research and a check, that is no treatment, against which to judge the effect of the experimental treatment.

Please note, I am using the term check to refer to what statisticians usually call the control or the control treatment. I am doing this to avoid confusion with the term control as applied to the southern pine beetle.

The check is essential to pilot testing control methods for the southern pine beetle. Without a valid check it is impossible to ascribe any observed effects to the treatment as opposed to changes that would have occurred even in the absence of the treatment.

Thus, applying a timber harvesting treatment to southern pine beetle infestations and observing a subsequent reduction in tree mortality is not sufficient, since it is possible that tree mortality would have declined naturally during and after the test period.

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Observations on the check provide a measure of natural changes in tree mortality against which any treatment caused changes would be clearly identifiable. A valid check for such a pilot test would consist of exactly the same field activities as the experimental treatment with the exception of the actual timber harvesting. In particular, monitoring procedures for the check should be identical to those for the treatment and should be done during the same time period.

Choosing experimental units in the pilot test, timber harvesting to control southern pine beetles, involves specification of regions or plots to receive the treatment in check. The plots must be large, because southern pine beetles are highly mobile, and the effects of the treatment may extend a considerable distance beyond the boundaries of the harvested region.

The cut-and-leave method is described as follows in "Direct Control Methods for the Southern Pine Beetle," an Agriculture handbook published by the Department of Agriculture. I quote: "The treatment disrupts spot growth and causes emerging beetles to disperse into the surrounding forest."

Thus, the plots must be large enough to allow the detection and measurement of any new spots which develop as a result of southern pine beetle dispersal.

The experimental units must respond independently to the treatment. That is, plots must be far enough apart so that the effects of the treatment in one plot cannot influence another plot. For example, the development of a new spot as a result of treatment could attract beetles away from nearby plots.

The experimental units also must be representative of a realistic and practical range of conditions. If this is not the case, the results of the pilot test may not be applicable to the entire range of conditions under which the treatment is to be used operationally.

For example, if all plots were located in stands with low tree densities, the results probably could not be extrapolated competently to other stands with higher densities. To avoid this shortcoming, plots should be chosen to represent a realistic range of densities. In addition to tree density, other conditions for which plots should be representative include stand age, stand species composition, spot size, spot density, beetle population levels, and season.

The primary observations to be made in a pilot test of a southern pine beetle control method are concerned with tree mortality, specifically the number of trees killed by beetles before, during and after timber harvesting. The comparison of tree mortality in the treatment plots with that in the check plots is an essential component in the evaluation of the efficacy of any control method.

Additionally, observations on stand attributes including density, age and species composition may be necessary. As discussed in "Treatment Tactics and Strategies" by David Wood, it is necessary to determine how changes in stand attributes resulting from treatment effects on bark beetle cause tree mortality, and affect productivity and the values of forest land.

In assigning treatments to the plots, systematic differences between treatment plots and check plots must be avoided. If such systematic differences are present in the pilot test, they will be inseparable from any treatment effects, when the treatment is com-

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pared to the check. Such a comparison is said to be biased. Randomization techniques are employed to minimize the possibility of systematic differences.

The essential feature of randomization is that treatments and checks are assigned to plots by an objective, impersonal procedure. It is impossible for the experimenter to subconsciously introduce systematic differences into the comparison.

The simplest form of a randomized experiment is the case where half of the plots are randomly chosen to receive the treatment, and the other half to receive the check. There are more complicated forms of randomization that are designed to deal with more complex situations.

For example, randomized block designs and stratified designs can be used in situations where plots can be divided into more homogeneous groups. Choosing the number of plots; that is, the sample size, is a critical part of designing the pilot test. If the number chosen is too small, the results of the test may be inconclusive, rendering the test useless. If the number chosen is too large, considerable effort and expense may be wasted obtaining a more precise estimate of treatment effect than is necessary.

For this discussion, a precise estimate is one which shows little variation; that is, it is always close to the true value being estimated. Although sample size determination is relatively simple in principle, it is frequently difficult in practice. If the experiment designer knows the magnitude of variability among the units, a sample size sufficient for any desired degree of precision can be calculated. Unfortunately, the magnitude of variability among the plots usually is not known in advance of the pilot test, so this operation is difficult to carry out.

Estimates of the magnitude of variability may be available from the field experimentation phase or from previous pilot tests, but my experience with bark beetle field testing is that the magnitude of variability is itself highly variable from time to time and place to place.

In summary, pilot tests to establish the efficacy of timber harvesting as a method to control the southern pine beetle, in order to be scientifically valid must adhere to the principles of experimental design. Specifically, such a pilot test must include: One, use of a valid check for comparison, two, plots that are large enough to allow detection of treatment effects including the development of new spots far enough apart that the treatment in one plot cannot affect other plots, and are representative of a reasonable range of operating conditions, three, measurement of tree mortality and stand characteristics before, during, and after the treatment period, four, use of randomization to assign treatment and check to plots, and five, a sample large enough to assure reliable estimates of treatment effects.

I cannot claim to have read all the publications pertinent to the efficacy of this control method, but I have examined some of the publications mentioned earlier today, including Dr. Billings' chapter in Technical Bulletin 1631. I know of no study of this treatment whose scientific validity is not seriously compromised, in my opinion, by failure to adhere to the principles I have just described; most notably, failure to include a check and failure to randomize.

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Thank you for the opportunity to address this committee.

Mr. SEIBERLING. Well, thank you. The bottom line is that there has been no truly scientific study of the efficacy of this particular control method versus other possible methods. Is that what it comes down to?

Mr. LINDAHL. Yes.

Mr. SEIBERLING. Now, in the absence of that, though, what is the matter with using an empirical sort of approach and saying "Well, we'll try this cutting and see if it works." According to the pictures that Dr. Billings showed, it does prevent the spread of the beetles to adjacent areas in some cases. What's the matter with that?

First, Dr. Waters.

Mr. WATERS. First is as we have mentioned; an apparent effect, or the effect observed, may or may not be due to the treatment or to the degree to which it is due to the treatment is indeterminate.

Second, it brings into question what criteria have been used to evaluate the success, if you will, of the treatment. There may be a single instance such as this exceptional case in the Four Notch location, but the general overall experience over a wide number of situations leaves us in doubt as to what measure of success has been used. I think it was Representative Bryant who pointed out, specifically on this point that if you have a definition, as is the case of these treatments and experiences described by Dr. Billings, the success or failure criterion is determined by the definition itself; and I would agree with him, as a matter of fact, that that definition is of questionable merit.

So there is this problem of determining, in any case, from such a large set of data on heterogeneous experiences, exactly what effect the treatment has had. This also brings into question variation in the manner in which the effects have been evaluated. To cap this, it does not provide us any measures or definite information on how to proceed in the next instance. Whatever they have apparently done, we do not have any basis for saying what to do the next time or in the next situation.

Mr. SEIBERLING. Well, in other words, it doesn't tell you whether it will reduce the number of trees killed by the beetles on an areawide basis; is that what you're saying?

Mr. WATERS. It tells us little or nothing about what will happen the next time we try to do it.

Mr. SEIBERLING. Yes.

Dr. Wood?

Mr. WOOD. Excuse me. The treatment actually could make things worse. If as our Forest Service colleagues, Swade and Remion state, "The treatment disrupts spot growth and causes emerging adults to disperse in the surrounding forest," and I question whether we know that or not—but if it is true, we will be making conditions worse for adjoining lands.

Why would we want to do that?

Mr. SEIBERLING. They claim that it doesn't; that it makes conditions better, and they cite the Four Notch example versus the areas where they've made the cuttings.

Mr. WOOD. You could be successful 100 percent of the time in preventing a spot from moving over this barrier, this cut area, and create a terrible problem of spot proliferation.

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So, it's——

Mr. SEIBERLING. In fact, I guess there have been situations where they have cut and eliminated spots, and the spots have proliferated beyond the area.

Mr. WOOD. That's right. That's right.

Mr. SEIBERLING. So what you're saying is they really don't know whether they're accomplishing any good result or not?

Mr. WOOD. Well, if you set your definition for success to be so narrow that if a breakout, a failure to control spot growth means that trees are dying in the immediate vicinity of this spot that you've treated over this barrier of cut trees, then they've already proven that they're 70 percent successful. But I contend that that's a specious argument.

Mr. SEIBERLING. All right. Then you are troubled by the use of the words "controlling spots" rather than controlling populations or controlling the spread of infestations; is that correct?

Mr. WOOD. I have a lot of trouble with Dr. Billings' commentary in that regard. It's hard for me to feature anything but beetles killing those trees. I mean, it can burn down, but it has to be tied to populations of insects.

Mr. SEIBERLING. So what they're really trying to control is not spots but destruction of trees over the whole forest.

Mr. WOOD. But you have to argue that you're lowering density of beetles at the same time.

Mr. SEIBERLING. Now, Dr. Wood, researchers at Clemsen University were recently commissioned by the Forest Service to design an experimental model to compare the costs of control versus noncontrol. That is, the costs of cutting versus not cutting.

Is that kind of model useful?

Mr. WOOD. It's the cart before the horse. If you don't have a treatment, why evaluate its cost? If you haven't proven scientifically, as we've tried to describe here today, that you have a treatment worth evaluating then determing the cost of the treatment is a useless exercise in my view.

Mr. SEIBERLING. Dr. Waters, if we stop cutting in one or more wilderness areas in Texas, do you think it would be feasible that a pilot test for beetle control could be set up using the wilderness as a control or a check?

Mr. WATERS. As a check, it certainly offers the possibility. Whether these particular wilderness areas are large enough and in themselves are representative enough of conditions in areas outside to be a comparison with a treated area, I don't know. I would strongly urge that both field experiments and pilot tests be conducted in any case on a sufficiently broad basis and that use be made of those wilderness areas to the extent that they would fit into such a program.

Mr. SEIBERLING. What do you think, Mr. Lindahl?

Mr. LINDAHL. Well, I agree with Dr. Waters with the exception of one point; and that is that use of wilderness areas for the check implies that you cannot randomize treatment and check unless you're willing to put treatment areas into the wilderness areas; and I don't think that was implied in your statement.

Mr. SEIBERLING. Well, you'd treat nonwilderness areas that were right next to it, let's say, or in the same area.

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Mr. LINDAHL. Right. The process of randomization, though, implicitly requires that every specified plot—the plots are specified in advance of assigning the treatments, has equal probability or equal possibility of receiving either the treatment or the check. It's that equal probability that in fact makes randomization a useful tool to avoid systematic biases.

If you predetermine certain plots will not receive the treatment, you can never rule out the possibility of a systematic difference between those plots and other plots to which you are making the comparisons.

Mr. SEIBERLING. But if your plots were the size of say 5,000 acres and you had wilderness areas of 5,000 acres where you did not act, and which were in the same part of Texas and were a similar type of ecosystem as where you did do the cutting, wouldn't that be the same as the randomizing with smaller plots?

Mr. LINDAHL. Not exactly, for a number of reasons that I haven't even begun to address here. But let me, rather than go into that, let me point out that when we say two areas are identical with respect to their ecosystem, all we can really say is we can't or haven't detected differences between them; and who is to say that there aren't differences that we've not detected, that we're not sensitive to.

Mr. SEIBERLING. How many plots do you need to randomize?

Mr. LINDAHL. Only two. But that's not a sufficient experiment in this case.

Mr. SEIBERLING. Well, I'm not sure I understand enough about the scientific factors here to be able to understand the distinction you're making; but——

Mr. LINDAHL. Oh, simply, if you just ask, how many do I need to randomize? You only need two to do the act of randomization. Clearly, an experiment with two plots is not sufficient for scientific validity.

Mr. SEIBERLING. How many do you need?

Mr. LINDAHL. That's impossible for me to say at this time. Again, I would refer to Dr. Waters' suggestions that three, four or five replicates might be more in the ballpark.

Mr. SEIBERLING. Would it be worth taking a look at these wilderness areas and comparing some of the adjacent areas of forest to see if they would lend themselves to this type of experiment? Not perfect, but would they be good enough?

Mr. LINDAHL. I certainly think it would be worthwhile. And it's probably possible to design an experiment which would include the plots in the wilderness areas as checks as well as some plots in nonwilderness areas that could also be used as checks and therefore be randomized along with treatment plots.

Mr. SEIBERLING. Well, they all look the same to me. I wouldn't go so far as Governor Reagan when he said, "You've seen one redwood, you've seen 'em all." But the east Texas forests go on and on, and they look like they're very similar, and over vast areas.

Thank you very much. Are there any other points? Yes.

Mr. WOOD. Chairman Seiberling, I would like to comment on the $500,000 price tag that Ron Billings gave the Congressmen earlier today. I think that $500,000 is not very much money these days to conduct the kind of work that has to be done to prove the efficacy

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of any treatment in a forestwide situation. I think we're looking at a several million dollars' program, sustained over a long enough period of time where the scientists can get the data they need to establish whether the treatment is efficacious or not. That's not been done.

Mr. SEIBERLING. Well, that's certainly the thrust of your testimony, all three of you, and the preceding witnesses, too. The Forest Service does have some problems. It does seem to me that their priorities need to be worked over a little bit in terms of research versus ad hoc efforts to deal with the problem.

Mr. WATERS. We would certainly agree.

Mr. SEIBERLING. All right. Thank you very much.

Our last panel consists of Dr. Fred Hain, Department of Entomology, North Carolina State University; and Dr. Thomas Mueller, Texas Department of Agriculture, Austin, TX.

Gentlemen, we appreciate your patience as well as your traveling this long distance to give us the benefit of your knowledge. I am sorry it has taken so long to get to you.

All right, Dr. Hain.

[Prepared statements of Dr. Fred Hain and Dr. Thomas Mueller may be found in the appendix.]

PANEL CONSISTING OF DR. FRED HAIN, DEPARTMENT OF ENTOLOMOGY, NORTH CAROLINA STATE UNIVERSITY; AND DR. THOMAS MUELLER, TEXAS DEPARTMENT OF AGRICULTURE

Dr. HAIN. Good afternoon.

Mr. SEIBERLING. I'd ask you to do the same as the other witnesses. If you could give us the high points of your testimony—oh, I see your statement's fairly short, Dr. Hain, so maybe it already is the high points.

Dr. HAIN. Well, it's so short I think I'll just ignore it; at least the first two pages of it. Instead, I think I'd like to respond to some of the comments that have been made during the day and perhaps read the last page of my testimony to emphasize the points that I came here to emphasize.

First of all, my name is Fred Hain, and I'm a professor of entomology at North Carolina State University. I've been there since 1974. I have done research on the southern pine beetle. During that time, I also did a postdoctoral experience in the Texas A&M University system; 12 months at the university itself and I actually spent 6 months with the Texas Forest Service. During all of that time, from the Texas Forest Service experience on through the present, I have been doing research on southern pine beetle, sampling population dynamics and most recently, studying host-insect interactions.

I'd like to start off by offering my sympathy to the Forest Service personnel. I think they're in a no-win situation; they are caught between a rock and a hard place. I don't think they are mindless bureaucrats; I think they are people who are forced into a situation, and they are responding to that situation in the best way that they possibly can.

On the one hand, they are receiving criticism from the Sierra Club and on the other hand they are receiving criticism from the

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private landowners in the surrounding area. So they are responding to that and doing the best job that they can. I don't necessarily agree with everything they're doing, but I certainly sympathize with their situation.

I guess my main concern about a lot of the discussion that occurred, especially in the morning session, is similar to what the previous panel expressed; and that is the unscientific nature of the information that is being presented to support areawide tactics for controlling southern pine beetle. And in particular I am concerned about the information that supports the cut-and-leave tactic. This information, as Dr. Waters pointed out, has not been acquired in a scientific manner, and is more anecdotal in nature, or trial and error in nature; and I think if we had a chance to look at that information very closely, we would find that there is a lot of controversy and a lot of contradictions in it. Sometimes it would work; sometimes it would not work. At least it would appear to work in some instances and not appear to work in other instances.

For example, in North Carolina, the cut-and-leave strategy was evaluated by the North Carolina forest service. This is information I obtained from Colman Doggett of the North Carolina Forest Service, who is essentially Ron Billings' equivalent in North Carolina. They evaluated the cut-and-leave strategy during 1974, which was an epidemic year for beetles in the State.

Their conclusion was completely the reverse of the Texas Forest Service. They concluded that cut-and-leave did not work; that it did cause a proliferation of spots after the treatment was applied, and they concluded that they would not recommend the use of cut-and-leave in North Carolina, and they have not done so ever since.

This was, as I pointed out, done in 1974. I should mention that this was not a scientific experiment. Again, it was just a trial and error operation, and they did not have the amount of experience with southern pine beetle that they do in Texas. North Carolina is a State that periodically has an epidemic situation, but we're not in a chronic epidemic situation year after year after year. As a matter of fact, we haven't had a significant southern pine beetle population in the State since about 1976 or 1977.

Nonetheless, their conclusion was completely the reverse. So the question then becomes, why do we have this confusion over this method? The first reason, which has already been expressed by others, is that the method has not been scientifically evaluated for its efficacy.

I think another problem has been that in all cases we have been dealing with looking at the method under epidemic situations. That is, where the southern pine beetle is overwhelming the system, so that it's totally out of control, and therefore things are just simply unpredictable. We cannot really adequately predict what's going to happen, because it's out of control.

Therefore, I want to make a case for doing studies under endemic, or low-level conditions where the situation is more stable and I feel we can more adequately address the efficacy of some of these treatments. So, let me just point out page 3 of my testimony and read that into the record.

Neither tactic—in this case I'm talking about the salvage tactic or the cut-and-leave tactic—neither tactic is likely to succeed in re-

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ducing an epidemic unless applied with great intensity—and I would say probably unrealistic intensity. The rapid treatment of infested areas—if we could do this—should reduce tree mortality, but the scientifically acquired data to support this is scarce. Research programs that evaluate the efficacy of both treatment tactics on an areawide basis should be funded.

In addition, high priority should be given to the evaluation of these tactics as well as other silvicultural treatments during periods of low southern pine beetle activity. It is my belief that the most promising means of controlling southern pine beetles is to minimize the probability of an epidemic's initiation. Thinning of densely stocked stands, maintenance of mixed pine/hardwood stands—especially in wilderness areas—rapid utilization of larger spot infestations and rapid treatment of small infestations, perhaps by cut-and-leave, a pheromone trapping treatment, or a combination of both—should provide ample measures for maintaining populations at low levels.

Based upon scientific and observational information, I feel confident about the reliability of each of the above treatments except the treatment of small infestations. The cut-and-leave and pheromone trapping strategies clearly need additional research. Under low level conditions, these tactics may prove to be quite useful. Under epidemic conditions, their utility may be severely limited.

I would like to applaud, Mr. Chairman, your concluding remarks earlier that the Forest Service perhaps should have allocated more of that $3 million they had for cutting into a research program. I think that is the basic thrust of what I'm trying to say here today. That is, that we have come a long way over the past 10 years in understanding the southern pine beetle system, but we still have a ways to go, and additional research dollars are still necessary.

I think the previous programs, which Dr. Thatcher was program manager of, have developed a great deal of technology, much of which can be used in evaluating the cut-and-leave strategy. For example, we now are capable of sampling populations or monitoring spots, of marking dispersing beetles, and of trapping dispersing beetles either with pheromones or flight traps.

I believe the technology is now available for doing an adequate evaluation of some of these tactics; especially the cut-and-leave tactic.

That's basically what I had to say. I wanted to make one further point on what Dr. Wood mentioned. He said that the cut-and-leave tactic may in fact create more of a problem than it solves, because it may cause a dispersal of the insects and then cause a proliferation of spots; and I agree with that.

There is one further point to that that I don't think anybody has mentioned today, and that is—and this is a rhetorical question because I don't know the answer to it—but what does that cut-and-leave tactic do to the synchrony of predators and parasites to its prey? There are a number of predators and parasites associated with southern pine beetle. How is the synchrony between their life cycle and the life cycle of the southern pine beetle disrupted by a cut-and-leave tactic? Is it possible that the disruption is so great that we may in fact be continuing or prolonging a southern pine

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beetle epidemic that would have otherwise died out during a shorter period of time?

Mr. SEIBERLING. Thank you for a very interesting statement.

Dr. Mueller?

Mr. MUELLER. Thank you, Mr. Chairman. I am Dr. Tom Mueller. I am an integrated pest management specialist with the Texas Department of Agriculture. I'm stationed in Austin. My areas of specialization are: insect/plant relationships and insect pest management.

The continuing controversy over the use of direct control measures, salvage and cut-and-leave, to control the southern pine beetle in wilderness areas combines two major issues. The first concerns the actual effectiveness of direct control measures for controlling individual localized southern pine beetle spot infestations and for managing southern pine beetle populations on an areawide basis. The second issue concerns the role of southern pine beetle in wilderness areas.

As you have heard today, there is a tremendous amount of disagreement as to the effectiveness of direct control measures, and I would like to address that point at this time.

Even though there haven't been definitive studies, we do have some studies that we can look to, at least for some indication of the efficacy of these treatments. One in particular was conducted by Billings and Pase and published in 1979 in a U.S. Forest Service Technical Bulletin, 1613. The title of the study was "Spot Proliferation Patterns As a Measure of Area-Wide Effectiveness of Southern Pine Beetle Control Tactics."

Now, this is a very complicated study involving examination of thousands of spots in east Texas. In addition, there were numerous simplifying assumptions in this study. But without going into great detail, the general conclusion was that salvage and cut-and-leave techniques apparently do reduce the incidence of new spot infestations, as long as those control measures were not used from October through December.

Direct control measures did not eliminate spot proliferation, but rather the number of new spots observed was less than the number of new spots expected without control efforts. However, the maximum reduction in the number of observed new spots relative to expected new spots was about 45 percent for salvage efforts that were conducted from January to May. These are the best conditions under which the direct control measures were evaluated.

Earlier today, Dr. Billings testified that his definition of effective was that it controlled or gave the desired results in a majority of the cases. According to the data presented in his 1979 article with Pase, the maximum level of control achieved was about 45 percent.

I need to stress that this was the maximum level of control. If you look at the control achieved from June to September, it was less than 30 percent. As far as I am concerned, and with my expertise in pest management, this is not at all effective control. At the very best, this is marginal effectiveness.

The direct control tactics of salvage and cut-and-leave may reduce spot proliferation of the southern pine beetle marginally under the best conditions, but even if salvage operations were conducted on every southern pine beetle spot in east Texas between

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January and May, it would not eradicate the pest or stop its spread. At best, it would slow the new spot proliferation by less than half. But of course it is not feasible to treat every southern pine beetle spot in this manner.

I might also mention that the effectiveness of the cut-and-leave techniques also dealt with in the paper by Billings and Pase was somewhat less than the effectiveness of the salvage techniques.

Salvage and cut-and-leave may be the best control measures we have right now, but they are really not very good from the pest management standpoint. The bigger issue is whether direct control measures are effective at substantially reducing southern pine beetle populations over large areas, and as some of the other speakers have mentioned already today in their testimony, there is little if any evidence that direct control measures have ever suppressed southern pine beetle outbreaks over large areas.

The focus of this hearing is on the Texas wilderness areas that comprise about 35,000 acres in east Texas. This is less than half of 1 percent of the estimated 10 million acres of forest in east Texas. So we are considering here a very small area relative to the total forest acreage.

If I could at this point, I would like to address the second major issue, and that is, what is the role of the southern pine beetle in wilderness areas? To answer this question, it is critical to understand the role of bark beetles in forest ecosystems, and I would like to quote from a book that has been previously mentioned; the title is "Integrated Pest Management in Pine-Bark Beetle Ecosystems" published in 1985, and I'd like to quote from a chapter written by Crookston and Stark:

> Therefore, if we assume conservatively that our pine forests became an entity 90 million years ago and their successional period is 300 years, then to date there have been about 300,000 turnovers of these forests. If we further assume that Dendroctonus bark beetles became distinct as a group 40 million years ago, that outbreaks begin when the forest reaches age 100 in each succession, and that subsequent outbreaks occur on the average of every 40 years, then a total of 1.5 million outbreaks would have occurred since bark beetles and pines began coevolving. Thus, there would have been at least . . . 390 million generations of southern pine beetle in the most favorable parts of its range. Only in the past 200 years have humans been imposing changes in bark beetle-forest ecosystems, causing unique conditions.
>
> In all cases, the primary ecological role of bark beetles is to remove selectively certain species and size classes of trees from mature, overmature, and climax forests.

The southern pine beetle is an integral part of the southern forest ecosystem, and has been for millions of years. Indeed, the southern pine beetle is a critical component. The natural southern forest ecosystem exists in a relatively stable climax state when viewed over a large area, but maintenance of this apparent stability is dependent upon localized changes in response to inevitable natural perturbations. By killing pines in pure, even-aged stands such as might result from fire, the southern pine beetle increases the vigor of remaining pines and facilitates the growth of the hardwood understory, thereby preserving the continuity of the ecosystem itself. Destructive efforts to control the southern pine beetle in wilderness areas do not benefit the wilderness.

Given these facts, the question is whether the value of direct control measures—salvage and cut-and-leave—justifies the destructive

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impact in wilderness areas of these measures. Given the data presently available, it is my opinion and that of the Texas Department of Agriculture, that the direct control measures are not justified. If further studies should show that control measures are indeed more effective, then I think it's time to look at that question again.

That is the conclusion of my testimony. Thank you for inviting me here today.

Mr. SEIPERLING. Thank you. It is interesting to me that we now have eight scientific witnesses, all testifying that there is no scientific basis for the approach being taken by the Forest Service, or Dr. Billings in particular, in terms of its efficacy to control pine-bark beetle infestations.

I thought that your suggestion, Dr. Mueller, was a very good one in terms of seeing if we couldn't utilize the wilderness areas for conducting an appropriate experiment. Now, you heard the previous panel, particularly Mr. Lindahl, say that he felt that you wouldn't get a sufficiently randomized set of areas for study purposes if you took the wilderness areas. Do you have any comment on that?

Mr. MUELLER. Yes. Indeed, I would have to agree with Mr. Lindahl on that. The way I had initially proposed the study was to use the five wilderness areas as the check plots and to select comparable plots in the national forest area that could be used, and in which direct control measures could be evaluated.

In many respects, this does violate some of the principles of randomization and lack of bias that Mr. Lindahl mentioned, and I am in agreement with him on that. However, sometimes it is necessary to compromise and, given the circumstances, I think if the comparable areas in the national forest that were used for the treatments could be chosen very carefully and with respect to a variety of factors, then at least it might minimize the problem of lack of randomization.

Mr. SEIBERLING. Well, we're never going to get two areas that are exactly the same, anyway.

Mr. MUELLER. That is indeed correct.

Mr. SEIBERLING. You could pick them side by side and they are only 10 acres; they are still going to be unique.

Well, now, your other alternative was to use pheromones in the wilderness areas; and of course that would be an interesting experiment. The only thing is, the whole idea of wilderness areas is to let nature handle the situation and not manipulate it by man. We do have compromises in the wilderness act about controlling fire, but by and large I think we control fire in wilderness areas mainly to prevent it spreading to nonwilderness areas, or destroying too large of an area.

Wouldn't this be a form of manipulation which would change the natural ecosystem of the wilderness area?

Mr. MUELLER. Yes, sir, it would. I think that as far as my proposal to utilize wilderness areas and spot infestations in wilderness areas to test and develop nondestructive control measures such as pheromone techniques is something that should be considered more or less as a last resort and that in my view, if it is a choice of utilizing some of these more experimental techniques of pheromone control versus direct control measures of salvage and cut-and-leave,

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it is far preferable to go with the less destructive pheromone approaches.

Mr. SEIBERLING. Of course, the reason why they're doing this in the wilderness areas is to try to control the spread of beetles to nonwilderness areas; and if there were no other concerns except the preservation of the wilderness, I suppose we wouldn't do anything; we would leave it alone.

So everything is a compromise, as one learns in this institution.

Well, I don't know that I have any other questions. Does staff have any questions?

We will keep the hearing record open for a reasonable period of time, and some of the members may want to ask additional questions.

I do appreciate the time that everybody has given and the effort they have made to come here, and I think it has been very helpful in getting the issues clearly defined; and I think your recommendation, Dr. Mueller, is one which we ought to pursue, and I will pursue it with my colleagues.

Dr. Hain, I thought you made some excellent points which don't need to be reiterated by me; but you confirm what the other witnesses have confirmed, and apparently your experience in North Carolina has tended to produce a different conclusion than the Forest Service's conclusions in Texas.

Oh, I did have one question I meant to ask both of you. What about the experience with the Big Thicket and with the Four Notch areas? Here the Forest Service says that the infestations appear to have spread from the area originally infested, and gone into private lands outside. Do you have any comments on that? This is not a scientific experiment, but they claim that that's what happened. Did they have any real proof? Is it possible to have scientific proof—I suppose it's possible but is their conclusion based on any scientific proof?

Mr. HAIN. No, it's not. It is possible, but I don't think there's any scientific proof to support it. It does seem like a logical——

Mr. SEIBERLING. So in your view they've drawn that conclusion, but they can't really prove it?

Mr. HAIN. No, I don't think so.

Mr. MUELLER. I might add that although I am not completely familiar with the Four Notch situation, it was my understanding that there were some beetle infestations or spot infestations outside the area as well, and that if that was the case, then it is difficult to say with great assurance that the continued spot growth was only from within. Perhaps it was, but I can't say for sure.

Mr. HAIN. You know, one problem with surveys that are done throughout the South is that small spots are pretty much ignored. It's only when they become larger than 10 trees that the State forest services begin to pay any attention to them. Well, most large spots are small spots at one time, so there is that added difficulty to interpreting the data. True, there may be additional spots that crop up outside of the Four Notch area, but the question is, When did they appear there? They may have been there for some time and just were not included in the survey until they became large enough to be included.

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Mr. SEIBERLING. Well I suppose if you lack other means of drawing conclusions, you make the most of the situation, and I would imagine if there is a large infestation of beetles covering a big area, it's reasonable to conclude that they will leave that area and go to another in the absence of better information, but it is not a scientific demonstration, as you say.

I guess we're left with the famous remark by Thoreau that, "Some circumstantial evidence is very strong, as when you find a trout in the milk." But it still doesn't prove how it got there.

So thank you very much, and this hearing is now adjourned.

[Whereupon, at 2:35 p.m., the subcommittee was adjourned.]

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APPENDIX

TUESDAY, MARCH 18, 1986

ADDITIONAL MATERIAL SUBMITTED FOR THE HEARING RECORD

STATEMENT OF

CONGRESSMAN JOE BARTON (R-TEXAS)

BEFORE THE

HOUSE PUBLIC LANDS SUBCOMMITTEE

HOUSE INTERIOR AND INSULAR AFFAIRS COMMITTEE

ON

SOUTHERN PINE BEETLE AND TEXAS WILDERNESS AREAS

MARCH 18, 1986

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Good morning, Mr. Chairman, members of the Public Lands Subcommittee. I am grateful for the opportunity to testify on the impact of the southern pine beetle on wilderness areas in Texas. As you may know, Montgomery County in my Congressional district is one of the areas most heavily devastated by the pine beetle. The Little Lake Creek Forest in the Texas National Forests also lies within my Congressional district, so I have an abiding interest in the fight against the beetle on Federal lands.

The southern pine beetle has been recognized for many years as the most destructive insect pest in southern pine forests. In 1985, 15,777 pine beetle infestations were detected in Texas alone. That year, the beetle destroyed an estimated 472 million board feet of timber, enough to build 47,200 homes. The standing value of this timber is estimated to be worth nearly $61 million.

Research demonstrates that the pine beetle prefers to attack older pines growing in crowded conditions, such as populate the National Forests in Texas. Although the Texas National Forests comprise only 6% of the commercial forest land in the state, they sustained nearly 30% of the timber killed by the pine beetle during 1985. I am concerned that the National Forests could become a breeding ground for the beetle and that it could spread to private lands that border the Forests. Obviously, some of my constituents share this concern.

It is my understanding that the subcommittee is interested in determining how best we can combat the beetle in the wilderness areas. As you know, the Texas Forest Service believe that the best way to combat the beetle is through selective "cut-and-leave" and "cut-and-clear" operations. Others believe that we should allow the beetle infestations, also known as "spots", to die out by themselves. Opponents of cutting cite evidence that cutting is not effective in all cases, while the Texas Forest Service cites instances where inaction allowed infestations to spread unimpeded across hundreds or even thousands of acres. According to the Texas Forest Service, about 5,000 acres of timber in the Big Thicket National Preserve were destroyed by the pine beetle last year when cutting did not take place. A similar event occured on the Beech Creek Unit of the Big Thicket National Preserve in 1976.

However, it appears that direct control methods such as cutting may not be appropriate in all instances. According to the Texas Forest Service, 30% to 50% of all spots become inactive without any application of direct control methods. The infestations that tend to die out by themselves are the smaller spots that contain less than 30 trees. I understand that the Forest Service monitors beetle spots in order to determine whether they surpass the 30 tree threshold, and that they generally base their decision on whether or not to cut on the size of the beetle infestation. Direct control methods should be focused on large southern pine beetle infestations.

The Texas Forest Service has also broken ground on pheromones research. Pheromones are beetle-produced odors that control beetle aggregation and other behavior in order to prevent the beetle from destroying pine forests in Texas and other states. Pheromones can be used to concentrate beetle populations on resistent or dead trees and decimate the beetles. They can also lure beetles to trees that have had chemical treatment. Other pheromones can disrupt pine beetles and repell them from pines that are under attack.

Much of this pheromones research has taken place at Texas A&M University, which is located in my district. Pheromones promises to be an effective way to combat the southern pine beetle without disturbing the National Forests. I hope that funding for pheromones research can be increased so we can develop this promising alternative sooner. I plan to request that the Appropriations Committee increase the funding for southern pine beetle research.

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Mr. Chairman, I am not a sciertist. I cannot say that I know the answer to the menace posed by the southern pine beetle. However, I must say that I believe that the Texas Forest Service has done a good job fighting the beetle over the years, and I am proud of their efforts. I hope that the testimony of the other witnesses will shed some light on this dire problem, and that they will be able offer some constructive comments on how we in Texas can improve our efforts to combat the beetle. The southern pine beetle is one creature that I would like to see become endangered, at least in Texas.

As you can see from the attached map, the southern pine beetle threatens 21 states in the United States, including the Chairman's home state of Ohio. I hope the Chairman and the subcommittee will support additional funding for research into the southern pine beetle.

Again, thank you for the opportunity to testify before you on something of such importance to my constituents. I hope that we can work together and develop the best control strategy to combat the southern pine beetle.

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RATIONALE AND JUSTIFICATION FOR DIRECT CONTROL OF SOUTHERN PINE BEETLE INFESTATIONS WITH EMPHASIS ON WILDERNESS AREAS

BY: Dr. Ronald F. Billings
Principal Entomologist
Texas Forest Service
Lufkin, Texas 75901

March 12, 1986

PURPOSE

The purpose of this statement is to present scientific justification and expert testimony supporting continued efforts by the USDA Forest Service to control southern pine beetle infestations on the National Forests, including control of certain infestations within recently-designated wilderness areas.

BIOGRAPHICAL INFORMATION

Since 1973, I have held the position of principal entomologist with the Texas Forest Service in Lufkin. As head of this agency's Forest Pest Control Section, I develop and administer programs of forest pest survey and control on all non-federal forest lands in Texas. The Section provides training and guidance to field foresters with the Texas Forest Service and forest industry in all aspects of forest pest management. I also conduct applied research on major pest problems with emphasis on the southern pine beetle. I have published numerous scientific articles and instructional handbooks on southern pine beetle detection, evaluation, suppression, and prevention, as well as basic studies on host selection and attack behavior of western and southern bark beetles. Included among these publications are two USDA Agriculture Handbooks on southern pine beetle detection (Billings and Doggett 1980) and ground evaluation (Billings and Pase 1979a), a chapter on direct control methods for southern pine beetle in USDA Technical Bulletin 1631 (Billings 1980) and an evaluation of southern pine beetle control tactics in USDA Technical Bulletin 1613 (Billings and Pase 1979b). In November, 1982, I served as a consultant for the USDA Forestry Support Program in Honduras and provided training and recommendations for control of southern pine beetle outbreak in that country.

I have maintained close contact with the southern pine beetle situation on National Forest lands in Texas and have provided requested inputs and recommendations to the Supervisor's Office, including background information

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used in preparation of the 1986 Environmental Impact Statement on Southern Pine Beetle Suppression.

Based on my educational background, knowledge of southern pine beetle biology and extensive experience with southern pine beetle control operations, I consider myself an authority on the subject and qualified to make the following statements with regard to the need for continued direct control efforts on National Forest lands, including control, under certain circumstances, in wilderness areas.

SOUTHERN PINE BEETLE BIOLOGY AND SEASONAL HABITS

A basic knowledge of the biology, seasonal behavior and population dynamics of the southern pine beetle is needed to understand the rationale for direct control. The following facts, detailed in USDA Technical Bulletin 1631, are pertinent:

The southern pine beetle, Dendroctonus frontalis, is the major pest of mature southern pine forests. Its destructive potential can be attributed to a very rapid life cycle (up to 7 generations per year in Texas), a high reproductive potential (each female is capable of laying up to 30 eggs per gallery and re-emerging to establish two or more galleries in different host trees), and the ability to successfully attack and kill apparently healthy trees when beetle populations concentrate in multiple-tree infestations.

Single infestations of southern pine beetle (SPB) may range in size from one isolated tree to several thousand acres. Historical records show that 75% of all multiple-tree SPB infestations are initiated during the Spring, and become detectable in aerial surveys during May, June and July in Texas and other Gulf Coastal States. These infestations usually originate in forest stands weakened by overcrowding, old age, flooding or drought. The initial tree to be attacked is often one that has been struck by lightning or affected by other natural disturbances. As female beetles begin attacking these weakened, defenseless trees, they produce a potent attractant, or "pheromone" which combines with resin odors from the tree to draw in other flying beetles. The end result is a mass attack and successful invasion of the host. If enough beetles respond to the attractant, the infestation spreads to adjacent trees. After mating, the attacking females deposit eggs in galleries constructed in the inner bark. Within 30 days, these eggs have developed into new adult beetles, which emerge to contribute to infestation expansion. In contrast, healthy trees can prevent initially invading beetles from producing pheromones by "drowning" them with a flow of resin. For this reason, SPB infestations seldom originate in healthy trees.

Unlike closely-related western bark beetle species having but 1-2 generations per year, the SPB has the unique capability of rapidly expanding single infestations from April through November through a process known as

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"spot growth." Spot growth occurs when beetles (both new adults and re-emergent parents) emerge from dead and dying trees within an established infestation and attack uninfested trees on the periphery of the same infestation, in response to beetle-produced attractants. In the presence of pheromones, flying beetles are induced to land and initiate attacks on uninfested standing pines within 20-100 feet of freshly-attacked pines. In this manner, large infestations may spread like slow-moving forest fires, killing virtually every pine in their path at the rate of up to 50 feet per day. Unlike with spot initiation, even healthy, vigorously growing pines seldom escape being killed as large infestations spread in this manner due to the high concentration of beetles and presence of attack-incuding pheromones.

Research by the Texas Forest Service and others has shown that spot growth is likely to occur whenever three criteria are met a) southern pine beetle infestations contain more than 30 currently-infested trees, b) temperatures remain above 60 degrees F, and c) additional uninfested pines are situated within the "area of influence" of pheromones produced by attacking beetles (e.g. 20-100 feet from freshly attacked pines, the distance being directly dependent on the size of the infestation). Sophisticated computer models for predicting rates of spot growth and potential timber losses in the absence of control have been developed by Texas A&M University and the University of Arkansas. These simulation models serve to illustrate benefits of prompt control action. During warm months beetles in a spot with 100 infested trees, for example, may kill 100-200 additional trees within 30 days if no control is applied. In large spots, spot growth and tree killing will usually continue until 1) no additional pines remain in the immediate vicinity of the advancing front, 2) cool weather or other environmental factors disrupt the necessary synchrony between continuous beetle emergence within the spot and pheromone production on the spot periphery, or 3) direct control is applied.

The initiation of new infestations, commonly termed "spot proliferation," is the primary beetle activity during the spring and fall months, while the expansion of existing infestations (spot growth) is the predominate means of beetle survival for several consecutive generations of summer-reared beetles. Relatively few new infestations are initiated between June and October; apparently, long-range beetle dispersal is curtailed during the summer by high temperatures and the poor physiological condition of emerging beetles. As conditions for beetle flight improve in the fall, some beetles may leave controlled and uncontrolled spots to initiate new spots nearby while the remainder of the beetle population remains in established infestations contributing to spot growth. Accordingly, from October to April, beetle populations again converge to form the many multiple-tree infestations that become evident in aerial surveys in early summer. During outbreaks, some 70% of all timber losses occur in large, expanding infestations, even though such spots represent only 30% of all spots detected (Billings 1980). These so-called "hot" spots are the primary target of current control programs.

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DIRECT CONTROL TACTICS AND STRATEGIES

The principal direct control tactics currently used to treat SPB infestations are cut-and-remove (salvage) and cut-and-leave. Cut-and-remove has been proven from extensive experience (including 20 consecutive years in Texas) to be a valid and effective means to control individual southern pine beetle infestations. Removal of all beetle-infested trees plus an appropriately-sized buffer of uninfested trees (40-60 feet) serves three purposes: 1) it prevents further timber losses from spot growth by disrupting the pheromone-induced attack process, 2) the size of the resident beetle population is reduced when beetle-infested trees are removed from the forest and utilized, 3) economic losses are reduced with the harvest and sale of beetle-killed timber. Cut-and-remove can be applied throughout the year whenever infestations are accessible to heavy equipment and there is a market for the infested timber.

Cut-and-leave is a simple, practical, and cost-effective method to disrupt spot growth and reduce potential timber loses in expanding spots that cannot be salvaged. The method involves felling all beetle-infested pines toward the center of the spot. In addition a 40-60 foot buffer strip of uninfested pines immediately adjacent to the most recently attacked pines is felled. The treatment, if properly and timely applied, successfully stops further spot growth by eliminating the source of beetle-produced attractants. (Recently-attacked pines rapidly lose their attracancy to beetles once they are severed from their root systems and placed in a horizontal position; also, the buffer strip eliminates all potential host trees within range of pheromone sources.)

Under operational conditions, control by cut-and-leave is recommended from May to October primarily to prevent additional timber losses that would occur from spot growth. Beetles that emerge from felled trees no longer encounter the pheromones that induce them to attack trees on the spot periphery. Thus, they are forced to disperse under hostile environmental conditions. It is important to understand that dispersing beetles, once outside the influence of pheromones, are not able to initiate new infestations wherever they encounter a pine tree. They must search out weakened or dying host trees and aggragate in large numbers to successfully initiate a new spot. During summer months, pines produce large quantities of resin as a defense mechanism. The drastic decline in the number of new spots detected after July suggests that most beetles are unsuccessful in initiating new multiple-tree spots controlled after September than around spots controlled by cut-and-remove or cut-and-leave during summer months.

The primary objective of direct control operations will vary depending on the season of the year and is related to the seasonally-changing habits of the beetle. Currently, most controls are applied during the summer months and are aimed at preventing further spot growth in spots initiated the previous spring. Control during the fall is important both for disrupting spot growth in spots not controlled during the summer as well as to reduce the beetle population prior to winter (the season of maximum reproductive potential).

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Control of known infestations during winter months is conducted on a limited scale primarily to reduce the size of overwintering beetle populations and to retard beetle population increases. Spots left uncontrolled beyond March provide the source of beetles capable of long range dispersal. The number and size of beetle infestations detected during summer months depends to a large extent on the size of the resident beetle population that survives the previous winter.

If possible, infested trees should be cut and removed during fall and winter months to reduce the size of the resident beetle populations allowed to overwinter. The reproductive potential and survival of the southern pine beetle reaches peak levels between October and May. Also, winter-infested trees produce beetles over a larger portion of the tree bole than do summer-infested trees. In effect, every tree infested during the fall and winter produces the same number of beetles as 3-5 trees infested during the hot summer months. If left uncontrolled during this period, beetle populations can increase dramatically during the four consecutive generations if optimal conditions of beetle survival and development prior to the next summer. Fortunately, beetles remain within infested trees from the 2-3 months during the winter (compared to about one month during the summer) allowing more time for salvage control. On the other hand, the scattered distribution of the slow rate of foliage fade characteristic of winter-infested trees hampers control efforts during this season.

EFFECTIVENESS OF DIRECT CONTROL TACTICS

How effective are current control tactics? In my opinion, a direct control tactic is "effective" under operational conditions if it is simple, practical and economical to apply, is successful in bringing about the desired effect in a majority of the situations under which it is applied, and causes no undue, undesirable and longlasting side effects. Based on these criteria, I consider both cut-and-remove and cut-and-leave to be effective for SPB infestation control. Admittedly, the level of effectiveness will vary with season of the year, size of infestation treated, and other factors. But until a better approach can be developed and extensively tested under operational conditions, these tactics offer the best alternatives available to cope with destructive southern pine beetle infestations. Cut-and-remove as well as cut-and-leave are applied with the sole purpose of reducing timber losses that are likely to result if no control is applied. By treating expanding infestations in early stages of spot development, spot growth processes are disrupted 70-80% of the time with a single treatment. On the remainder a second treatment usually achieves the intended goal. By treating during the summer months, expanding spots are rendered inactive before favorable conditions for beetle dispersal and new spot proliferation return in the fall. Thus, potential timber losses from spot growth as well as eventual new spot proliferation are minimized.

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It is important to stress that the goal of direct control tactics for southern pine beetle is not beetle population control (as with western bark beetles), but damage control. Indeed, Texas Forest Service records from nearly thirty years of control programs have confirmed that, regardless of the control tactics used (toxic chemicals, cut-and-remove, cut-and-leave), it is not possible to eradicate the beetle or even to drastically change the course of outbreaks in terms of total number of infestations that will occur in any given year. The latter is more dependent on the abundance of susceptible hosts and environmental conditions that either favor or discourage beetle reproduction. Besides, in the case of southern pine beetle, only a relatively small proportion of active spots receive control action. A sizeable portion of the beetle population escapes control pressure in small, undetected spots or larger infestations that are inactive at time of detection. Ironically, unless a new spot expands beyond about 10 trees, the beetles will usually have completed development and abandoned the spot by the time the foliage discolors and the spot becomes detectable from the air during warm months. Also, most controlled spots are treated during the May-October period. The high reproductive potential and survival rate of winter-reared beetles, coupled with the scattered distribution of winter-infested trees, often permits beetle populations to "bounce back" from control pressure the summer before. Even though it is unrealistic and impractical to strive for or expect population control under these complex circumstances, direct control is still warranted to avoid timber losses from individual infestations within a given year. In commercial forests, long-term protection from SPB outbreaks can best be achieved through forest management practices that reduce the susceptibility of forest stands (e.g. thinning and timely harvest).

Cut-and-leave has been used instead of insecticide control for non-salvageable spots in Texas since 1970. With the discontinuation of intensive use of insecticides for SPB control after 1969, cut-and-leave was developed by Texas forest managers out of necessity to reduce timber losses in spots that could not be readily salvaged. The fact that the Texas Forest Service and major forest industries in Texas continue to use cut-and-leave attests to its practicality and efficacy for disrupting spot growth. Cut-and-leave is most effective for disrupting spot growth if applied during summer months to infestations with less than 100 beetle-infested trees. During the period 1973 - 1985, cut-and-leave was applied to 7326 infestations on private lands in east Texas, while 8962 spots were controlled by salvage. Unlike with toxic chemical sprays, the use of cut-and-leave favors survival of the beetle's natural enemies (predators and parasites) which can successfully complete development in felled trees. The use of synthetic pheromones for direct control (attractants and/or inhibitors) shows promise but remains experimental.

Sequential aerial photography was used by the Texas Forest Service in 1976 to document the benefits of prompt control by cut-and-remove and cut-and-leave. This study (see article by J. R. Wood in USDA Technical Bulletin 1613) showed that timber losses were reduced by 85% through prompt control of infestations, compared to no control or delayed control.

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Further support for prompt control of southern pine beetle infestations is provided from historical records. The largest infestations (ranging in size up to 5000 acres) of southern pine beetle in east Texas since 1970 have occurred in areas where control was never applied, was delayed or was prematurely discontinued. Infestations on the Beech Creek and Lance Rosier Units of the Big Thicket National Preserve during 1976 and on the Four Notch unit of the Sam Houston National Forest in Texas during 1983 developed in areas being purchased or considered for preserve or wilderness areas. During 1984 and 1985, more than 5000 acres of pine forests on the Big Sandy Unit of the Big Thicket National Preserve near Livingston, Texas were killed by the beetle, as a result of a "no control" policy by the National Park Service. There is little doubt that the huge beetle populations allowed to develop under these conditions contribute to sizable timber losses on adjacent ownerships, both as a result of spot growth and long range beetle dispersal (spot proliferation). Other forested areas with similar stand conditions in Texas have escaped such massive beetle infestations because of the prompt control action that has become an inherent part of routine forest management. For example, in 1984 and 1985, numerous SPB infestations were successfully controlled within Huntsville State Park, a recreational area with mature pine stands similar to those devastated by the beetle on nearby Four Notch in 1983 - 1984 (Billings and Varner 1986).

WHY CONTROL SPB INFESTATIONS IN WILDERNESS AREAS?

Once southern pine beetle infestations attain a size of several hundred acres, such as the infestation in the Four Notch unit in 1983, they cannot be controlled without sacrificing large numbers of uninfested trees, disturbing the site with heavy equipment, or suffering numerous breakouts or proliferations. Clearly, it is preferable to control infestations while they are still small (less than 100 trees). In wilderness areas, prompt control of expanding infestations results in only minor and temporary site disturbance and is essential to prevent spread to adjacent commercial forest lands, both private and federal. Also, direct control is often required to protect nesting areas of the red-cockaded woodpecker, an endangered species.

The Texas Forest Service is particularly concerned with the spread of beetles from wilderness areas on to nearby private forest lands. (More than half of the wilderness boundaries in Texas border on private forest lands.) A recent Texas Forest Service study (Billings and Bryant 1983, Billings et al 1985) documents the current susceptibility of Texas National Forest lands in general and wilderness areas in particular to outbreaks of southern pine beetle. Of 32 grid blocks (18,000 acre units) rated as high hazard to southern pine beetle in east Texas in 1983 (based on abundance of susceptible pine stands), 27 grid blocks (84%) contain National Forest lands. The Little Lake Creek, Upland Island and Turkey Hill wilderness areas fall largely within high hazard grid blocks while Indian Mounds and Big Slough Wilderness Areas are located in grid blocks rated as "moderate hazard". In 1983, based on these data, I predicted that southern pine beetles would present a continual threat to pine stands in proposed wilderness areas due to the high susceptibility of individual trees, dense stands of mature pine and optimal SPB habitat that characterize these

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areas. This forecast was confirmed during the SPB outbreak in 1985 (Table 1 attached). Those 18,000 acre grid blocks containing wilderness areas supported approximately twice as many SPB infestations compared to grid blocks with National Forest lands void of wilderness within the same counties. (The only exception was the Big Slough Wilderness on the Davy Crockett National Forest which contains many acres of bottomland hardwoods.) Similarly, those grid blocks within the same counties that support only private forest lands recorded only about one fourth as many spots as grid blocks containing federal wilderness. The message is clear. Pine stands in and around wilderness areas in Texas, regardless of ownership, have a high risk of SPB infestation. This risk can only increase if a "no control" policy is adopted for wilderness areas.

In my professional opinion, the current forest pest management policy of direct control practiced by the National Forests in Texas is the most rational approach to the southern pine beetle problem in wilderness areas, given the current circumstances (Billings 1986). This approach, to date, has involved the evaluation of all SPB infestations to assess growth potential (Billings and Hynum 1980) and judicious use of cut-and-leave or cut-and-remove to prevent spread of expanding spots that threatened colonies of the endangered red-cockaded woodpecker or adjacent managed forest lands.

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ATTACHMENT A:

Table 1: Comparison of southern pine beetle infestation density per 18,000 acre grid block for 1985 in nine counties of east Texas, as influenced by the presence of National Forests and wilderness. (Data provided by the National Forests in Texas and Texas Forest Service.)

		Mean Number of SPB Infestations Per Grid Block		
Counties	National Forest	Grid blocks with only private forest lands	Grid blocks with national & private forest lands (exc. wilderness)	Grid blocks with wilderness
Angelina & San Augustine	Angelina	9.8 (30)**	18.6* (19)	41.4* (6)
Sabine & Shelby	Sabine	10.0 (22)	24.0 (30)	46.8 (4)
Trinity & Houston	Davy Crockett	16.5 (15)	45.4 (30)	37.5*** (2)
Walker, San Jacinto & Montgomery	Sam Houston	31.4 (54)	90.3 (31)	156.0 (3)
	AVERAGE	20.3 (121)	47.5 (110)	65.2 (15)

* Mean number of infestations on federal, industry and private forest lands.

** Numbers in parentheses indicate total number of grid blocks per category.

*** The two grid blocks supporting the Big Slough Wilderness Area contain a large acreage of bottomland hardwoods - non-hosts for SPB.

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MICHAEL L. STRANG
3d District, Colorado

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Congress of the United States
House of Representatives
Washington, DC 20515

April 8, 1986

Max Peterson
Chief, U.S. Forest Service
USDA
P.O. Box 2417
Washington, D.C. 20013

Dear ~~Mr. Peterson~~ Max

The following questions are submitted as followup to the March 18, 1986 oversight hearing on the Control of Southern Pine Beetles in Wilderness Areas conducted by the House Committee on Interior and Insular Affairs, Public Lands Subcommittee. Please forward your responses to my office as soon as possible.

1. Does the Environmental Impact Statement (EIS) on southern pine beetles that the Forest Service is preparing address the Texas wilderness areas? What is the status of the EIS?

2. Do any of the alternatives you are evaluating in the EIS consider leaving an area completely alone and letting nature take its course?

3. If the decision was made not to cut in a wilderness area to control the pine beetle and the infestation spread to adjacent private land, what would be the potential federal liability?

4. What would the impacts be of taking no control measures for the southern pine beetle in each of the Texas wilderness areas? Consider such factors as potential impacts to adjacent private lands, natural barriers, presence of red cockaded woodpeckers, current condition and type of timber, etc. Give your response by wilderness area.

5. Do you feel that if one or more of the Texas wilderness areas were left alone as an "experiment" this would provide any additional information that would be applicable to decisions made regarding control or noncontrol of the southern pine beetle in wilderness areas in other parts of the country?

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6. When the Forest Service cuts and removes trees from wilderness areas to control the beetle, is the timber sold? If so, how do you reconcile selling the timber with Section 4(c) of the Wilderness Act which states "... there shall be no commercial enterprise and no permanent road within any wilderness area...", wouldn't selling of the timber be a commercial enterprise?

7. What were the impacts to the red cockaded woodpecker in the Four Notch area? Are the colonies still there?

8. Did the Big Thicket Preserve have any red cockaded woodpeckers? If so, what impacts did the National Park Service's decision not to utilize control measures, except at its boundaries when adjacent lands were threatened, have on the woodpecker colonies?

9. Did you feel that the testimony of the expert witnesses at the hearing adequately reflected the "state of the art" of knowledge concerning the effectiveness of control methods for the southern pine beetle and the impacts of no control?

With best wishes,

Sincerely,

MICHAEL L. STRANG
Member of Congress

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United States Department of Agriculture | Forest Service | Washington Office | 12th & Independence SW P.O. Box 2417 Washington, DC 20013

Reply to: 3400

Date: APR 25 1986

RECEIVED
MAY 6 1986
Michael L. Strang, M.C.
Washington Office

Honorable Michael L. Strang
House of Representatives
Washington, DC 20515

Dear Congressman Strang:

This responds to your letter of April 8 with followup questions to the March 18, 1986, hearing before the House Committee on Interior and Insular Affairs, Subcommittee on Public Lands, about southern pine beetle control.

The following are answers to your specific questions:

1. Does the Environmental Impact Statement (EIS) on southern pine beetles that the Forest Service is preparing address the Texas wilderness areas? What is the status of the EIS?

Answer: The southern pine beetle suppression environmental impact statement (EIS) that we are preparing covers the Texas wilderness areas. We anticipate a draft environmental impact statement will be available for public comment by July 1, 1986.

2. Do any of the alternatives you are evaluating in the EIS consider leaving an area completely alone and letting nature take its course?

Answer: At this time there are two alternatives being considered in the EIS process which would result in no action in wilderness areas. There is a no action alternative where southern pine beetle would be allowed to run its natural course on all lands. There is also a no action alternative in wilderness and integrated pest management to control southern pine beetles in the general forest area.

3. If the decision was made not to cut in a wilderness area to control the pine beetle and the infestation spread to adjacent private land, what would be the potential Federal liability?

Answer: There may be a potential for Federal liability if a decision was made not to control a southern pine beetle spot and the infestation subsequently spread to adjacent private land. Two tort claims have been filed against the Forest Service claiming damages from the spread of southern pine beetle from wilderness areas onto private land. These claims have not yet been settled.

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4. What would the impacts be of taking no control measures for the southern pine beetle in each of the Texas wilderness areas? Consider such factors as potential impacts to adjacent private lands, natural barriers, presence of red-cockaded woodpeckers, current condition and type of timber, etc. Give your response by wilderness area.

Answer: A thorough analysis on the impact of control versus no control in the Texas wilderness areas is being addressed in the environmental impact statement. This analysis has not yet been completed.

The Texas wilderness areas contain the following red-cockaded woodpecker colonies and miles of adjoining State and private lands:

Wilderness	No. of RCW Colonies	Miles of adjoining State and private lands
Big Slough	1	9.7
Indian Mounds	1	13.3
Little Lake Creek	12	1.6
Turkey Hill	1	7.6
Upland Island	6	21.1

5. Do you feel that if one or more of the Texas wilderness areas were left alone as an "experiment" this would provide any additional information that would be applicable to decisions made regarding control or noncontrol of the southern pine beetle in wilderness areas in other parts of the country?

Answer: We do not believe that leaving one or more of the Texas wilderness areas alone as an "experiment" would provide significant new information about southern pine beetles and their control. We believe that the Big Thicket and Four Notch are sufficient demonstrations of what can happen when southern pine beetle spots are not controlled or when control is significantly delayed.

Using the Texas wilderness areas as part of an experiment to statistically "prove" the effectiveness of controlling southern pine beetle spots versus no control in wilderness areas might be possible but would present many difficulties. Good statistical design dictates the need for randomization; this means that any area involved in such a test needs to have an equal chance of being selected for treatment or no treatment. Consequently, a wilderness area could be selected as a treatment area rather than an untreated check. Treated and untreated areas need to be identical. Also, each overall treatment block, including check areas, must be sufficiently large so the treatment is not affected by infestations on the adjoining land. Some of the Texas wilderness areas are rather small. This complicates their suitability as study areas. Nevertheless, if a study could be adequately designed, there is a possibility the wilderness areas could be used. Study results should be applicable to other areas in the South.

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6. When the Forest Service cuts and removes trees from wilderness areas to control the beetle, is the timber sold? If so, how do you reconcile selling the timber with Section 4(c) of the Wilderness Act which states "... there shall be no commercial enterprise and no permanent road within any wilderness area...", wouldn't selling of the timber be a commercial enterprise?

Answer: Section 4(c) of the Wilderness Act states that "Except as specifically provided for in this Act, ... there shall be no commercial enterprise ... within any wilderness area designated by this Act."

Section 4(d)(1) provides that "... measures may be taken as may be necessary in the control of fire, insects, and diseases, subject to such conditions as the Secretary deems desirable."

As a matter of longstanding policy, we let natural processes, including normal insect and disease activity, operate within wilderness areas unless failure to take action would cause substantial damage to private or public resources outside the wilderness area. The presence of the red-cockaded woodpecker within or adjacent to a wilderness area introduces another important factor because of Federal law relating to protection of endangered species. The loss of mature, live pine trees to the southern pine beetle could seriously threaten red-cockaded woodpecker colonies.

7. What were the impacts to the red-cockaded woodpecker in the Four Notch area? Are the colonies still there?

Answer: In the Four Notch area there were 12 red-cockaded woodpecker colonies. The trees in six colonies were killed by the southern pine beetle. These six colonies have been abandoned by the red-cockaded woodpecker; the remaining colonies are still active.

8. Did the Big Thicket Preserve have any red-cockaded woodpeckers? If so, what impacts did the National Park Service's decision not to utilize control measures, except at its boundaries when adjacent lands were threatened, have on the woodpecker colonies?

Answer: We have no knowledge of the status of the red-cockaded woodpecker on the Big Thicket Preserve. We respectfully refer you to the National Park Service for this information.

9. Did you feel that the testimony of the expert witnesses at the hearing adequately reflected the "state of the art" of knowledge concerning the effectiveness of control methods for the southern pine beetle and the impacts of no control?

Answer: We believe that Dr. Donald Billings accurately portrayed that there is reasonable evidence, from a long history of use and from what we know about southern pine beetle behavior, to support the effectiveness of our recommended southern pine beetle controls. The expert witnesses accurately portrayed that there is no scientific "proof" that the cutting of individual infested southern pine beetle spots has any impact on area-wide control of southern pine beetle populations. We believe that

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additional research is needed. We also believe that the overwhelming majority of Forest Service and university entomologists who have worked on the southern pine beetle problem support the concept of treating individual spots to prevent additional tree killings. (See the testimony of Dr. Fred Stephen, page 2, paragraph 2.)

We hope this information is useful to you. We appreciate your interest in the health of our Nation's forests.

Sincerely,

for F. MAX PETERSON
Chief

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STATEMENT OF CONGRESSMAN JOHN BRYANT

BEFORE THE SUBCOMMITTEE ON PUBLIC LANDS

OF THE HOUSE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS

Honorable Chairman and members of the Subcommittee:

I am shocked and saddened every time I have seen the devastation that the U.S. Forest Service is causing in the Texas Wilderness in the name of controlling Southern pine beetles.

The Forest Service buffer cuts not only fell huge, healthy pine trees, but in the process knock the limbs and tops off the oaks and hickories and smaller pine trees as the big pines fall through them.

And it galls me to see the ruts of the heavy equipment that enters the wilderness when the felled pines are commercially sold.

Other Congressmen and I, with support of thousands of our constituents, worked for years to save these beautiful areas for wildlife and recreation and to preserve them intact for our children. Congress passed the East Texas Wilderness Act to stop the Forest Service from methodically and indiscriminately cutting the trees. We never expected that the Forest Service would immediately find an excuse to resume logging operations as they have done.

Today, I would like to assist this subcommittee in seeing through the sophistry that the Forest Service is dispensing to justify its pine beetle cutting program.

Dr. David L. Wood of the University of California, and other nationally respected forest entomologists have presented sworn statements that there is no scientific proof that buffer

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cutting controls the population or movement of Southern pine beetles. In reply, the Forest Service entomologists have said many times that they were not cutting to control the population or movement of Southern pine beetles. I quote from an affidavit of Forrest L. Oliveria, U.S. Forest Service, Pineville, Louisiana, a witness for the Forest Service in the Texas Southern pine beetle case and again in the Washington, D.C. case:

> "The affidavit by David L. Wood indicates that he is of the opinion that no direct control methods for the treatment of Southern pine beetle infestations have scientifically been proven successful in either controlling population size or in preventing population movement. It is my opinion that control of Southern pine beetle populations on an area-wide basis has not yet been adequately researched. However, controlling population size or preventing population movement as suggested by Wood is not the purpose of the United States Forest Service Southern pine beetle control program. The Forest Service control program is for the control of Southern pine beetle populations in an individual spot and, in my opinion, the control of Southern pine beetle populations in an individual spot can be effectively accomplished."

That statement by the Forest Service raises the logical question: If the cuts are not known to control populations on an area-wide

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basis nor movement of beetles from one spot to a different spot, then why should the Forest Service be allowed to cut in wilderness at all?

My answer to that question is that they should not cut in wilderness.

The Forest Service has stated many times its two over-all objectives of cutting inside wildernesses:

-- to contain infestations to wilderness areas,

-- to prevent infestations from spreading to Red-cockaded woodpecker colonies. I attach to my statement a paper listing twelve Forest Service statements to that effect.

It seems very clear to me that, in the absence of proof of controlling larger areas, the control of individual spots can not be accepted as preventing Southern pine beetles from infesting pines outside wildernesses. Yet the Forest Service implies that control of spots must somehow aid in the protection of totally distinct and separate spots elsewhere.

The Forest Service position might not be so obviously phony if all their cuts in wilderness were on the boundary line. But that is not the case. They are cutting as deep within wilderness areas as possible. In Upland Island, that is up to a mile and a half inside boundaries which are only three miles apart. They are cutting even further away from Red-cockaded woodpecker colonies.

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Here is what is happening. The Forest Service is not able to hire entomologists who are willing to claim proof that cutting in one or more spots will stop the beetles in other places. Their entomologists will not challenge the independent experts head-on. But they will, and do, try to leave the impression that their cutting actually has the effect that they admitted they could not prove. That is misleading at best or just downright deceptive.

here is what the Forest Service witnesses go on to say. They say that their cutting is effective. When pinned down, they mean that, by their own definition, they control individual spots. But their definition is highly self-serving.

To the Forest Service, control or success means that, after a spot has been cut once or more, the beetles no longer infest any of the pines immediately adjacent to the cut. If the beetles fly to other pines twenty-five yards away, or a half-mile away, as they can and often do, the Forest Service counts that as a fresh spot, and counts the former cut as a success. They say they have controlled the first spot because that is all they mean by control. By their definition, it is inevitable that they will claim a very high rate of success. And the more destructive cutting they do, the greater successes they will claim.

Another way they put it is that control is achieved when there are not more break-outs from a spot they have cut. They define a break-out as follows:

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"....when Southern pine beetles emerging from a treated spot attack neighboring, immediately adjacent trees.... When uninfested host trees are located between the treated spot and the new infestation, when the new infestation is considered a separate spot. The breakout must occur within thirty days of treatment of the spot."

There again I have quoted the testimony of the Forest Service's own expert, Oliveria, in the Washington, D.C. beetle case now pending.

In Forest Service bureaucratese, all they have to do to succeed is to keep on cutting break-outs until the beetles fly a short distance outside the buffer. Mind you, beetles are still boring away, but they had to move to do it.

Imagine a quail hunter who defined one-hundred percent success as where he shot more of the birds and forced the rest to fly to a new spot!

The Wilderness Act of 1964 calls for areas to be left unmarred, except as may be "necessary in the control of fire, insects, and disease". The definition of "necessary" is:

"essential to a desireable or projected end."

As to buffer cutting, in wilderness, the Forest Service's end is to protect commercial pine timber outside the wilderness. There is no proof that the cutting achieves that end; therefore, it is not essential to that end. Therefore, it is not necessary. Since it

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is not necessary, the Wilderness Act, in my opinion, does not allow it.

I ask the subcommittee to put a stop to the buffer cutting for Southern pine beetles in all federally protected wilderness areas where they exist.

Last summer during an inspection of beetle cutting conducted by this subcommittee, I stood in a clearing of about 100 acres. It was in what had been a deep and shady forest well inside Upland Island Wilderness. The Forest Ranger told our group that after a small infestation of beetles months earlier, they had cut buffer after buffer, and each time the beetles had broken out, until finally, after 27 cuts, the Forest Service had achieved control. I pointed out there were three new spots, just outside the wilderness boundary which we had observed en route, and asked:

"How can you claim to have controlled the beetles if they flew outside the boundary and started new spots?"

To which he replied, "There haven't been any new infested trees adjoining this cut for thirty days."

"But you did not keep the beetles from infesting the lands outside the boundary," I pointed out.

To which he insisted, "But we kept them from enlarging this spot."

We have already lost 100 acres of forest in this one wilderness

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area alone. Yet the beetles had infested the pines outside our wilderness anyway -- exactly what the Forest Service said it was attempting to prevent. But, by Forest Service standards, the cutting was a success. I say that those standards are ridiculous and in no one's interests.

Throughout the wilderness areas, the Forest Service has been cutting for beetles, yet there were about as many spots per square mile along the outside of the wilderness boundary as inside the boundary. The beetles during this epidemic have been everywhere where there were many pines. For 2½ years, the Forest Service has cut as fast as they could. They brought in crews from other states to cut more and more. But their unproven and unprovable policy did not prevent the epidemic from becoming the largest in recorded history.

It is clear to me that when the beetles are infesting trees throughout the forest, we do not protect any part of the forest by cutting spots, any more than we could protect part of a child's body during a case of the measles by cutting the spots as they broke out.

The experts agree that when pine trees become too dense, pine beetles will periodically peak and destroy some of them. We can not curb the epidemic by cutting spots. In wilderness areas cutting does not just cause tremendous harm. It defeats the purpose of establishing the wilderness in the first place. I have heard the Forest Service claim that the beetles, if left uncontrolled, would damage the wilderness anyway.

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I have stood in a remote place in the wilderness where beetles had killed many pines but the Forest Service had not intruded and cut. Most of the dead pines had lost their needles, bark, then twigs, then limbs, then 90 percent of their water content, but were still standing. The few that had finally fallen were so light that they caused little damage to surrounding oaks, hickories, and gums.

All around the dead pines stood healthy hardwood trees, providing pleasant shade. The forest floor was cool and moist. Turkeyberries and occasional wildflowers provided patches of color. Birds sang. It was still wilderness--the living woodland where death nurtures life.

In contrast, out where the Forest Service had cut buffers of green pines, crashing pines had blasted the hardwoods. Vehicles had completed the scarification of the soil. It was like a clearcut, a war zone, a desert.

That frightening sort of contrast needn't exist in our wilderness. I do not want to see it happen anymore. Neither does anyone who honestly wants to preserve a little bit of today's natural heritage for tomorrow.

I am confident that this subcommittee will take prompt action to stop the buffer cutting in wilderness that promises only devastation.

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STATEMENT OF
FREDERICK M. STEPHEN
PROFESSOR OF ENTOMOLOGY
UNIVERSITY OF ARKANSAS
FAYETTEVILLE, ARKANSAS

Before the
Subcommittee on Public Lands
Committee on Interior and Insular Affairs
United States House of Representatives

On: Control of southern pine beetle infestations in the Southeastern United States, with emphasis on Texas wilderness areas

March 18, 1986

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

My name is Frederick M. Stephen. I am a forest entomologist with a Ph.D. from the University of California, at Berkeley. I am a member of the Society of American Foresters, The Entomological Societies of America and Canada, plus other professional and scientific organizations. Currently I am a Professor in the Department of Entomology at the University of Arkansas, Fayetteville. My professional responsibilities include teaching and research in insect ecology, biological control and forest entomology. I have been actively involved in southern pine beetle research for 12 years, and have published numerous articles on various aspects of its biology and management.

The issue of whether attempts at direct control of southern pine beetle have been successful has not been scientifically resolved. An important reason for this is that although many control methods have been shown to kill southern pine beetle individuals, there is little evidence demonstrating control of beetle populations. From a scientific perspective, the ability to kill beetles and the ability to control

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populations is not synonymous. Successful control implies reduction of populations and corresponding damage below some acceptable level. Killing beetles within specific trees, or even within a specific infestation, does not mean that damage at the stand level has been likewise reduced. These insects are good fliers and very mobile, and they have high reproductive capabilities coupled with short generation times, which means their populations can grow extremely rapidly in an area. Thus, killing them in limited numbers or merely effecting their dispersal to another area may not be significant in reducing area-wide damage.

An important consideration involves defining the extent of control which is being attempted. If the level of desired control is the elimination of most or all the beetles within a particular infested tree, then this can be accomplished with various chemicals or by removing and burning the infested bark. If the intent of control is to stop the spread of a particular southern pine beetle spot's growth, then utilization of existing methods such as salvage, or cut and leave have been shown to often be effective. The larger issue, however, as to whether these or other methods of direct control have been scientifically shown to be effective in reducing area-wide populations of southern pine beetle and the resultant damage they cause has not, in my judgement, been demonstrated.

Researchers have, during the past decade, developed the technology to adequately sample bark beetle populations on an area-wide basis, and to assess the amount of damage associated with these beetles. It remains, however, a costly and difficult endeavor. This may explain in part why no adequate experiments on area-wide evaluation of control of southern pine beetle populations have been published.

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Direct Control: Options and Limitations

Chemicals are registered for southern pine beetle control, but generally are limited to specialized situations and are seldom used under large-scale forest management situations. Their ability to kill beetles within trees is well documented, but their effectiveness at controlling area-wide populations has not been demonstrated. Their lack of effectiveness at the population level, coupled with expense, effects on beetle natural enemies, and other environmental considerations makes their large-scale use unlikely.

Salvage, which is the cutting and removal of dead, infested, and a buffer of uninfested trees from a southern pine beetle spot, is often considered a preferred method of direct control. It appears that salvage can often successfully stop spot growth in a specific stand, plus it can result in recovery and use of infested timber. Southern pine beetles may be removed from the stand with the infested trees. If they emerge prior to removal, the integrity of the spot has been disrupted by the cutting, and a pheromone source may not exist for the beetles to aggregate to, which may result in beetle mortality or dispersal. As with chemical control, however, the actual impact of this control method on area-wide populations is undetermined, particularly since bark beetle natural enemies are also removed from the stand during salvage. Other considerations often associated with this control strategy are a need for access roads to facilitate log transport, and problems with tree marketability (e.g. price, quality, mill capacity, and log storage) during outbreaks. The beetles that are in felled infested trees, which are decked or taken to mills, can still develop and may successfully emerge and disperse into another forested area.

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Cutting infested trees as well as a buffer of uninfested trees at the active edge of a southern pine beetle spot and leaving them in the forest is also utilized as a direct control strategy for southern pine beetle. In this situation the beetles are not removed, but the process of felling infested trees and a buffer of uninfested trees is intended to disrupt the pheromone communication of the beetles, and eliminate the visual stimuli of vertical trees immediately adjacent to the recently infested trees. Speculation would suggest that this procedure works by causing the beetles to disperse. Where the beetles go during dispersal has not been established, nor has the amount of mortality to beetle populations been determined. Bark beetles are generally good fliers, with one study indicating flight of at least 15 kilometers. Thus, the effect of this control method on area-wide populations is uncertain. Beetles may die during dispersal, may initiate new spots, or may locate and join other infestations. Experimentally this is very difficult to determine, and no data have been published which prove that cut and leave is a control strategy that can be relied upon to reduce or eliminate area-wide populations of southern pine beetle.

Pheromones, which are an essential element for southern pine beetle success in locating and killing trees, have great promise as a control strategy, but the complexity of the system is such that much more research is needed before they can be adequately or consistently utilized.

Research Needs

This brings me to perhaps the main reason for my statement. It is not my intent to criticize the Forest Service or any other agency for utilizing salvage or cut and leave as a control strategy. They are under

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a great deal of pressure to do something to alleviate infestations. Adequate evaluation of control alternatives is complex, expensive, and perhaps unlikely to be looked upon as wise use of funds. What is most dramatically illustrated by the lack of adequate direct control methods for this most important forest insect pest is that sufficient research on many aspects of its biology and ecology is still lacking. During the past 12 years there has been a South-wide effort to develop management systems for this pest. A tremendous amount of critical information has been acquired and is being utilized. Funds for research on southern pine beetle have, however, recently been drastically cut and currently there is no organized program to develop integrated forest pest management systems for this beetle. Good cooperation between the Forest Service and University scientists has been demonstrated, but long-term studies are needed on basic issues of beetle/tree/stand dynamics which can ultimately lead to successful management. University and Federal scientists are presently initiating a program to meet these needs, and a Southern Regional Development Committee has been formed to develop a Southern Regional Research Project concerned with southern pine beetle management. Such an effort can only be successful if research money is available and funds are allocated in a competitive manner for both long and short term basic and applied research.

Issues of Wilderness and Southern Pine Beetle Control

The southern pine beetle is a natural component of the Southern pine forest ecosystem. It is a native insect which has coevolved over millions of years with its pine hosts and the other plant and animal species found in southern pine-hardwood forests. The southern pine beetle is one of the

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reasons why natural, unmanaged forests in the southern United States eventually become uneven-aged mixtures of both pine and hardwood species. Pure stands of pine, which frequently develop as a consequence of fire, mature to a certain age and stand density, and become susceptible to southern pine beetle. The beetles kill pines in these stands, thereby increasing the vigor of the remaining trees by opening the forest canopy and allowing the hardwood understory to grow and mature.

Proper management of southern pine beetle populations requires an understanding of the forest ecosystem, and why the insect may cause so much damage in forests that are primarily monocultures of pure, even-aged, overmature pine. As long as forests of this type abound in the South, southern pine beetle will always be a threat. Proper management of southern pine beetle requires, in my estimation, a silvicultural viewpoint. Short-term approaches to controlling southern pine beetle populations will most likely only provide short-term solutions, or may fail altogether.

Short-term approaches involving direct control of southern pine beetle outbreaks, such as cut and leave, or salvage operations have not been scientifically demonstrated to reduce area-wide beetle populations. Even if direct control techniques were shown to reduce damage in a specific infestation, it is almost certain that southern pine beetle will continue to be a problem in the area unless the forest stand conditions that led to the outbreak are alleviated. There appear to be two alternatives. (1) Intensively manage wilderness areas (for a variety of uses) and maintain forest structure and composition in such a manner that stand hazard is very low and southern pine beetle infestations are unlikely. (2) Let southern pine beetle alone in wilderness areas. They will, through time, kill susceptible pines existing in dense or overmature

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stands, eventually influencing forest structure and composition so that the likelihood of large southern pine beetle outbreaks will be minimized. If this philosophy were followed, however, wilderness would need to be unmanaged (i.e. not protected); not for insects, diseases or fire, but rather let "nature take its course". In my view wilderness cannot be partially managed. The philosophy of containment of southern pine beetle cannot work unless forest stands are changed to the point where stand hazard is sufficiently low so that even with high populations of southern pine beetle, severe infestations should not occur. The conditions required for southern pine beetle outbreaks demand both susceptible stands and some minimum level of southern pine beetle population. Devastating infestations are unlikely, if forest stand conditions are unsuitable, even if surrounding beetle populations are high.

I realize that the complexity of issues surrounding the philosophy of wilderness areas is sufficiently great as to cloud any simple statement on what should, or should not be done about forest protection. I do believe, however, that short-term solutions to problems such as southern pine beetle in wilderness areas are liable to raise more problems than they solve.

This concludes my prepared testimony Mr. Chairman. Thank you for the invitation to comment on these issues.

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Southern Pine Beetle Management in the Big Thicket

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Results from my research on factors influencing southern pine beetle population growth in east Texas (from 1979 to 1981) demonstrated that small populations of this bark beetle (killing less than one tree per day) are very sensitive to tree spacing. A 20 ft. spacing is usually sufficient to promote tree vigor and biochemical defense against bark beetles and to prevent attraction of sufficient numbers of beetles (via disruption of mating attractants) to kill additional trees. However, large populations of the beetle (killing more than one tree per day) are less sensitive to tree spacing and may kill additional trees across relatively broad clearings. This change in effect of spacing at large populations sizes reflects a reduced dependence of the beetles on mating attractants to focus sufficient numbers of beetles to kill trees. In other words, thinning or creating open buffer zones could effectively limit small bark beetle populations, but extensive clearing of buffer zones may be necessary to contain large populations. Although experience supports thinning or clearing as control tools, critical experiments with adequate controls have not been performed.

The wisdom of applying bark beetle control strategies to wilderness or potential wilderness areas requires consideration of the goals for establishing wilderness. One goal is clearly the preservation of particular community types, either for their unique qualities or for endangered species habitat. This goal is unrealistic because it dissects a component community from an integrated ecosystem and leaves this small island of habitat vulnerable to uncontrollable disturbances, such as fire, windthrow, insects or pathogens. If, on the other hand, ecosystem values are emphasized as goals, then factors influencing ecosystem integrity, such as management effects or maintenance of a stable mosaic of community types, must be addressed. Wilderness areas serve as a baseline against which we can measure management effects on environmental quality and site productivity. Clearly, introduction of management activities compromises this wilderness use. Wilderness areas also serve as habitat refuges. Protection

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of the unique and potentially useful gene base represented by each species (especially endangered species) in each community requires protection of the habitat requirements for these species. However, because all communities change through time, an appropriate mosaic of community types is necessary to ensure continuous habitat. Management activities directed at any single species can jeopardize other species.

Numerous ecosystem studies, including my own, demonstrate that apparently small changes in any species population can have dramatic effects on ecosystem structure or function. Cutting groups of trees in an unbroken forest exposes remaining trees to wind and frost damage. Extensive windthrow is a common result of staggered-setting clearcutting, the practice of clearcutting small patches within the forest matrix. Tree injury or stress is known to increase tree susceptibility to southern pine beetle attack. Other insect populations also may increase in response to the increased availability of injured or stressed trees resulting from cutting. The single-species approach to forest pest management has often resulted in unexpected and destructive outbreaks of non-target species. Spider mite and scale insect outbreaks resulting from pesticide application against defoliators or cone and seed insects, and root weevil outbreaks and associated disease transmission resulting from precommercial thinning in Douglas-fir plantations provide notable examples of unexpected but serious responses of unrecognized pests. Forest insect complexes, including those in east Texas, are too poorly known to anticipate the various responses of non-target species to wilderness cutting.

Understanding of key processes through which natural communities are organized is essential to protecting ecosystem integrity. Failure to protect ecosystem integrity can result in recognized loss of ecosystem values, such as the increased erosion, reduced water quality and slow revegetation resulting from vegetation removal. While tree mortality to bark beetles may appear to represent disruption, ecosystem studies suggest that these insects play a key role in maintaining a stable mosaic of community types which maximizes ecosystem stability.

Pine forests persist only where periodic fire provides suitable soil conditions for seedling germination and protects the fire-tolerant pines from hardwood competition. However, pine seedlings cannot survive under a forest canopy. Hence, as unmanaged pine forests mature, opportunities for replacement of injured or stressed trees by young pines are rare. This situation is exacerbated where fire exclusion permits development of a dense hardwood understory and gradual replacement of pines by hardwoods. Southern pine beetle activity is probably an important

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mechanism for killing stressed trees and providing the fuel accumulation necessary to ensure fire and the occurrence of soil conditions necessary for pine regeneration in unmanaged forests. Elimination of fire or southern pine beetle from the Big Thicket ecosystem will result in replacement of the uneven-aged pine and pine-hardwood forest by pure hardwood forest.

The uneven-aged mixed forest structure of unmanaged forests is central to the stability and persistance of this system. Because no single forest age class or species mixture is resistant to the full range of environmental fluctuations and disturbances (for example, ice storms, fire, drought, flooding) characterizing east Texas ecosystems, the mosaic of community types resulting from patterns of fire and southern pine beetle activity minimizes the distance for plant and animal colonization of suitable sites. The ecosystem is thereby stabilized against excessive soil and nutrient losses during reforestation.

The mosaic of communities in unmanaged forests likely also limits the spread of fire and bark beetles over extensive areas. The mosaic of hosts and non-hosts, susceptible and non-susceptible age classes, etc., provides natural barriers to fire and bark beetles. If left unmanaged, fire and southern pine beetle could be expected to affect relatively small patches of suitable trees. Unfortunately, only small patches remain unmanaged. By contrast, extensive, closely-spaced, even-aged pine host conditions characterizing managed plantations are more likely to induce and support continuous southern pine beetle activity. This situation increases the vulnerability of small islands of preserved habitat to this insect.

This testimony should make clear the fact that while thinning or clearing buffer zones could limit populations of the southern pine beetle, application in potential wilderness areas can have unpredictable effects on non-target species and potentially detrimental effects on processes critical to the persistance and stability of the Big Thicket ecosystem. Wilderness values should not be jeopardized to protect adjacent lands where thinning for bark beetle control could be accomplished more easily and more appropriately.

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Statement of Dr. Jerome A. Jackson Relative to Red-cockaded Woodpeckers and Problems with Southern Pine Beetles in Wilderness Areas

My name is Jerome A. Jackson. I am Professor of Biological Sciences at Mississippi State University (Box Z, Mississippi State, MS 39762). I am also a Director of the U.S. Section of the International Council for Bird Preservation, Liaison between the Wilson Ornithological Society and the Fish and Wildlife Service Office of Endangered Species, and Editor of the journal Bird Conservation. The emphasis of my research for the past 16 years has been the endangered Red-cockaded Woodpecker. This research has resulted in over 30 publications on this species. I served as Team Leader of the Red-cockaded Woodpecker Endangered Species Recovery Team of the U.S. Fish and Wildlife Service for eight years. I have studied the Red-cockaded Woodpecker throughout its range.

The role of wilderness in providing habitat for Red-cockaded Woodpeckers and the problems related to Red-cockaded Woodpecker colonies in wilderness areas are too complex to adequately discuss in this verbal statement. Appended to the transcript of my verbal statement is a manuscript which will be published in the proceedings of a symposium on wilderness which was cosponsored by the U.S. Forest Service and the Wilderness Society. This manuscript, "The Effects of Wilderness on the Endangered Red-cockaded Woodpecker," is coauthored by Dr. Bette J. Schardien Jackson of

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Mississippi State University, and by Dr. Richard N. Conner of the U.S. Forest Service. My verbal statement will summarize and expand upon points made in the manuscript.

The Red-cockaded Woodpecker is endangered due to habitat loss. Although most remaining populations occur on southern National Forests, those as well as others continue to decline. Within the past 10 years, the species has disappeared from three National Forests (Tombigbee and Holly Springs in Mississippi, and Oconee in Georgia) I have documented the loss of several colonies on Texas National Forests.

Each breeding group of Red-cockaded Woodpeckers must have an average of about 200 acres of open pine forest, much of which is 80-100+ years old. Such old trees are used by the birds for their nest and roost cavities and provide better feeding sites. For a population to persist, there must be several breeding groups within a short distance. Thus, in the long term, hundreds to thousands of acres of mature, open forest are needed. Use of the forest by Red-cockaded Woodpeckers does not preclude harvesting of trees. It does, however, limit the ways in which trees can be harvested.

Major problems faced by Red-cockaded Woodpeckers are (1) having adequate acreage of old forest, and (2) having forest habitat that is open. The first precludes existence of large populations on private or commercial forest lands since private

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ownerships are often small and commercial forests are managed to maximize return - and hence require cutting at an early age. Disappearance of many colonies from National Forest lands can similarly be attributed to cutting of older trees and management on short rotations. Wilderness areas, because of their protection from harvesting, have the potential of providing exceptionally good habitat for Red-cockaded Woodpeckers. However, many colonies - including colonies within wilderness areas on National Forests - have been lost due to the lack of management which maintains an open forest.

Before arrival of European man, the pine forests of the south were burned by lightning-started fires at about 3-5 year intervals. Although we normally think of fire as a destructive force, in the case of southern pine forest ecosystems, fire plays an essential and positive role. Southern pines tolerate fire, but are intolerant of shade. Many hardwood trees, on the other hand, tolerate shade, but not fire. Before the arrival of European man, a lightning-started fire might have burned for miles, keeping pine forests open and eliminating hardwoods which would otherwise kill young pines by shading them. Construction of roads and clearing of lands limited the extent to which natural fires could burn. Many forests which would naturally have been open pines are reverting to hardwoods. Because wilderness areas on southern National Forests are relatively small, the potential for fire to play its natural role is minimal, and if fire is not introduced by man, the resulting

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wildernesses will end up being very unnatural.

In addition to controlling hardwoods, fire also thins young pines, an important consideration relative to the southern pine beetle. The open pine forest that is favored by Red-cockaded Woodpeckers has trees so sparsely spaced that competition among trees is reduced and southern pine beetle populations are limited because of the greater distances they must travel between trees. The lack of an adequate frequency of fire on southern National Forests has resulted in an overcrowding of pines as well as an invasion of hardwoods. This overcrowding stresses the trees, making them more vulnerable to southern pine beetles, and because of the closer spacing, the beetles can spread rapidly.

With its proposal to "protect" Red-cockaded Woodpecker colonies from southern pine beetles by cutting buffer zones around them, the Forest Service takes a "crisis management" approach rather than a "crisis prevention" approach. There are major flaws in reasoning associated with the buffer zone plan. The first is the implied assumption that any pine beetle attack will destroy Red-cockaded Woodpecker colonies. Entomological research has demonstrated that the average southern pine beetle infestation is less than an acre. Pines can and do survive near other trees that are being killed by southern pine beetles. None, however, survive if they are clearcut.

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Cutting of buffer zones can negatively affect the birds by: (1) reducing nearby food resources, (2) eliminating potential cavity trees, (3) increasing the risk of southern pine beetle infestation as a result of injury to trees adjacent to those cut, (4) increasing the risk of wind damage to cavity trees, (5) making birds more vulnerable to predators as they fly across newly created open areas, and (5) possibly upsetting normal behavior as a result of cutting activities.

Southern pine beetles have decimated some forests in Louisiana and Texas and there is potential for other such epidemics. Would cutting a buffer zone around Red-cockaded Woodpecker colonies in such areas save those colonies? It might save cavity trees, but in my opinion it would not save the birds in the event of a catastrophic infestation. The plan to clear buffer zones implies that if one saves the cavity trees, the birds will survive. They are not likely to survive if the surrounding forest is killed. The large home ranges of Red-cockaded Woodpeckers are not incidental to the welfare of the birds. They are needed to provide an adequate food supply. Since in excess of 90% of the feeding of Red-cockaded Woodpeckers is done on live pines, the birds cannot persist for long if only their colony site remains.

It is my opinion that the Forest Service should manage southern wilderness areas that would have naturally supported southern pines by assuring that either natural or man-caused fires burn the forest at a frequency that would have occurred

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before arrival of European man. With a "natural" fire regime reinstated, the forests of the wilderness areas would revert to their original state, suitable habitat would be provided for the Red-cockaded Woodpecker and other components of the southern pine forest ecosystem, and southern pine beetle populations would be naturally controlled.

Finally, until such a fire regime can be reinstated, some measures may be appropriate to protect Red-cockaded Woodpecker colonies. Such measures, however, do not need to include cutting of buffer zones. Attractant and repellant chemicals are known which could be used to attract southern pine beetles to traps and to keep them away from Red-cockaded Woodpecker colony sites. These chemicals only affect the beetles and would not otherwise disturb the wilderness ecosystem.

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The Effects of Wilderness on the Endangered Red-Cockaded Woodpecker

Jerome A. Jackson[a], Richard N. Conner[b], and Bette J. Schardien Jackson[a]

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Abstract.--The endangered Red-cockaded Woodpecker (Picoides borealis) is endemic to mature open pine forests of the southeastern United States. Fewer than 100 colonies exist on presently designated wilderness areas, but potential for increased numbers and the significance of these populations is high. Problems associated with the species on wilderness areas relate to its specific habitat requirement of large acreages of mature open forest. Aboriginally these forests were kept open by lightning caused fires. Human influences limit such fires today and wilderness managers should strive to recreate aboriginal conditions. Data on frequency of electrical storms in the southeast suggest that such fires occurred during the

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summer months, as opposed to the cooler winter fires that are now generally used during prescribed burns. The lack of fire has resulted in development of dense hardwood understories and dense stands of pines, both unfavorable to the Red-cockaded Woodpecker. In addition, the dense stands of pines provide conditions favorable to the southern pine beetle (Dendroctonus frontalis Zimm.), a species capable of destroying large tracts of pine forest. A fire regime favorable to the Red-cockaded Woodpecker would not only open up the habitat, but would also help control some insects harmful to pines.

Introduction

The Red-cockaded Woodpecker (Picoides borealis) is an endangered species that is endemic to the mature, open pine forests of the southeastern United States. Its populations are thought to include between 3000 and 10,000 individuals, with perhaps as many as 80% of those occurring on public lands (Jackson 1971, 1978; Lennartz et al. 1983b). Habitat needs and the unusual ecology of this species have been summarized by Hooper et al. (1980). Briefly, these include a unique social system, home ranges averaging about 80 ha (200 acres), low fecundity, use of living pines 75+ years old for cavity excavation, use of living pines for 90+% of foraging activities, strong site tenacity, and a proclivity to abandon sites when the understory grows to reach the lower branches of cavity trees. The species seems as dependent on fire in its natural

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environment as the pines in which it lives (Garren 1943).

In this paper we examine the known distribution of the species on wilderness areas in the southeastern United States and the potential effects of wilderness and wilderness management on the species. Particular emphases will be placed on wilderness size, the role of fire in southeastern wildernesses, and problems with southern pine beetles (Dendroctonus frontalis Zimm.).

Wilderness Areas and Red-cockaded Woodpeckers in the Southeastern United States

Distribution.-- For the purpose of this paper we identify a wilderness as an area designated as such by the congressional mandate of the Wilderness Act or by similar actions of a state. Some other areas, such as the Big Cypress Preserve in Florida and some back country National Park lands, will be discussed because of their similarities (relative to Red-cockaded Woodpeckers) to designated wilderness.

A cursory review of federal lands in the Southeast that have been designated as wilderness reveals that most are bottomland, swamp, or island environments that do not include suitable habitats for Red-cockaded Woodpeckers. The few wilderness areas that do include populations of Red-cockaded Woodpeckers are identified in Table 1.

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Of federally designated wilderness areas with Red-cockaded Woodpeckers, the U.S. Fish and Wildlife Service administers one, and the U.S. Forest Service administers eight (Table 1). In addition, one state-designated wilderness (McCurtain in Oklahoma) includes the woodpeckers.

Major wilderness populations of Red-cockaded Woodpeckers are those on Texas National Forests; the Kisatchie Hills Wilderness, Kisatchie National Forest, Louisiana; Okefenokee National Wildlife Refuge, Georgia; and the McCurtain County Wilderness Area, Oklahoma.

The McCurtain County Wilderness Area in southeastern Oklahoma includes one of the largest "wilderness" populations of Red-cockaded Woodpeckers. Wood and Lewis (1977) found 29 active colonies there and suggested that the population had been relatively stable throughout recent history.

There are historical records of Red-cockaded Woodpeckers from the vicinity of some other wilderness areas and in some areas that have been proposed for wilderness status. A small population of Red-cockaded Woodpeckers occurs in the Great Smoky Mountains National Park (Tanner 1965), part of which has been proposed for wilderness listing (Anon. 1971). Whether or not official wilderness status is gained, the remoteness, terrain, and National Park status probably assure "wilderness-like" habitat associated with these colonies.

Although there are no known Red-cockaded Woodpecker colonies in the Everglades National Park, there are approximately 40

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colonies just north of the Park in the Big Cypress Preserve, which has a wilderness-like character (Patterson and Robertson 1981; JJ and BJ, pers. observ.). Maturation of pine forests in proposed wilderness areas of the Everglades National Park (Anon. 1971) could produce habitat into which the birds could expand. Prior to logging early in this century, Red-cockaded Woodpeckers were known from the Everglades (Howell 1921, Holt and Sutton 1926).

Although Red-cockaded Woodpeckers have been reported (Wilson 1961, Mengel 1965) from the vicinity of proposed wilderness (Anon. 1971) in Mammoth Cave National Park, there have been no recent sightings of the species there. Prior to wilderness designation, there was one sight record of a Red-cockaded Woodpecker from Horn Island, off the coast of Mississippi (USDI 1968).

Wilderness size and population viability.--Perhaps the most dense population of Red-cockaded Woodpeckers known is that on the Francis Marion National Forest, South Carolina, where Lennartz and Henry (1985) reported 406 colonies on 66,775 ha of suitable habitat. A colony never includes more than one breeding pair, although male offspring from previous nesting efforts may remain with the pair as helpers. Three birds per colony have been used as an average in estimating population sizes (e.g., Jackson 1971). Assuming such a density approaches the maximum possible for the species, most wilderness areas on

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which Red-cockaded Woodpeckers have been reported could support fewer than 300 birds, even if their entire acreage was suitable habitat. Most of these areas include a variety - and some a majority - of habitats unsuitable for the species. Such a population size falls far short of the minimum of 500 breeding individuals thought needed for population viability by population geneticists (Franklin 1980).

When compared to the species' estimated total of 3000 to 10,000 birds, the numbers known on wilderness areas seem insignificant. But are they? When dealing with an endangered species whose populations are becoming increasingly fragmented, the genetic variability of all populations of the species may be important for its survival. We know that the species has declined at the hands of man and it is quite possible that current management efforts on behalf of the species will be unable to change population trends. If crucial elements of the Red-cockaded Woodpecker's aboriginal environment are not being provided by modern forestry, the species' salvation might rest in restoring the primeval conditions through protection and management of wilderness. It is our opinion that in the interests of seeking to assure a future for this endangered bird, and more importantly, for the ecosystem into which it was born, at least one major population of the species should be managed in a manner as much like the prehuman environment as possible. To assure ecosystem viability, based on the minimum viable population of Red-cockaded Woodpeckers as suggested by

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Lennartz and Henry (1985), such a wilderness may need to include at least 20,235 ha (50,000 acres) of fire-climax pine forest.

The wilderness that was here before man's arrival in the Southeast cannot be re-created solely by legislative protection of set aside areas. Man has changed Southeastern environments such that to reproduce the Red-cockaded Woodpecker's natal environment will require an understanding of the natural forces that sustained it and the human disturbances that brought about changes in it.

The Role of Natural Fire and Need For Prescribed Fire for Red-cockaded Woodpeckers in Wilderness Areas

One of the environmental factors which most influences the Red-cockaded Woodpecker and its environment is fire. Fire plays several significant roles in the maintenance of the pine forest ecosystems of the Southeast: it (1) prevents hardwood encroachment, (2) prevents overcrowding of pines, and (3) kills some pathogenic fungi (Parmeter and Uhrenholdt 1974). These effects all result in a healthier, less stressed forest. As a secondary result, the pines are less susceptible to attack by the southern pine beetle and other insect pests (Belanger and Malac 1980, Wahlenberg 1946a) because of their increased vigor and the increased dispersal distance between trees for the insects. The southern pine forests to which Red-cockaded Woodpeckers are endemic are fire-climax ecosystems. Without

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fire, succession would result in replacement of pines by fire intolerant hardwood ecosystems.

Since the arrival of early Indian cultures in the Southeast, man has burned the forests deliberately and accidentally (Wright and Bailey 1982). Deliberate burning has included fires used in association with hunting, to maintain grassy understories for grazing, to move back the wilderness for safety reasons, and more recently, to manage for production of pulp and lumber.

Prior to such human intervention, lightning started fires likely swept through the forests as frequently as annually in Florida (Bancroft 1976) and at less frequent intervals to the north (Heinselman 1981). It is difficult to collect data on the frequency of prehistoric fires, but much can be inferred from our knowledge of species' habitat requirements and modern climatological data. These inferences are important to an understanding of the dynamics of wilderness ecosystems today. The comments below are predicated on the assumptions that (1) the habitat needs of Red-cockaded Woodpeckers and southern pines and (2) climatic patterns, particularly the frequency of electrical storms, have not changed dramatically since the arrival of the first human cultures in the Southeast.

Modern fire records in the Southeast suggest that today only about 4 % of forest fires are caused by lightning, with most of the rest being caused by man (Anon. 1979, 1980). These statistics cannot be taken as indicative of prehistoric lightning-caused fire rates, however, for two main reasons: (1)

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man-caused fires reduce natural fuels, and thereby reduce the potential for lightning ignition of those fuels; and (2) modern forests are much younger than the old-growth that would have been characteristic of primeval forests, and as trees mature, they produce proportionately more litter which falls to the forest floor (Kittredge 1948). For example, Kittredge (p. 171) demonstrated a linear increase in litter depth in stands of loblolly pine (Pinus taeda L.) varying from 10 to 70 years old. Finally, the average acreage burned by individual wild fires in the Southeast today can be anticipated to be much less than what would have been burned before the arrival of European man. Each road that is built acts as a firebreak to restrict the potential extent of wildfires.

Stone (1965), Ghiselin (1974), and Parsons (1977) document the need for fire to play its natural environmental role if wildernesses are to be naturally functioning ecosystems. Unfortunately, the traditional approach to "preservation" of natural areas has usually involved suppression of fires (Heinselman 1970, Stone 1965).

Since the primeval frequency of fires in southeastern forests would have been dependent on the frequency of ignition of forest fuels by lightning, a primary clue to the dynamics of prehistoric fire is the frequency of electrical storms in the area. Figures 1-3 (from Anon. 1952) illustrate variation in annual, winter, and summer frequency of electrical storms in the United States. The extreme southeast has one of the highest

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electrical storm frequencies in the world, with that frequency decreasing clinally to the north and west. Examination of electrical storm frequency by month further reveals that few storms occur during the winter months (Figure 2) and most occur during summer (Figure 3). Although there are other factors involved (Fuquay et al. 1972, 1979), the magnitude of the difference in seasonal frequencies suggests that fires might have been more frequent in summer than at other times of year.

Winter and early spring fires tend to be cooler and have been used most frequently by forest managers, with the resulting decrease in litter precluding natural fires in summer. When hardwoods become an exceptional problem in areas managed for pine, prescribed burns in summer are used (Riebold 1955, Lotti 1956, Bruce and Nelson 1957). It seems likely that the unique and extreme adaptations of longleaf pine (Pinus palustris Mill.) to fire (e.g., Wahlenberg 1946b, Hare 1965) may be the end product of a long association with periodic hot summer fires. The apparent preferences of the Red-cockaded Woodpecker for longleaf pines and open forest habitats also seem linked to such fires (Jackson 1971, Hooper et al. 1980, Lennartz et al. 1983b).

Another factor facilitating frequent fires is the well-drained sandy soil of the southern coastal plain. To the north, increased clay content results in poorer drainage and more moist, less flammable litter on the forest floor. This, accompanied by a rapidly decreasing incidence of electrical storms (Figures 1-3), would have resulted in less-extensive and

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less-frequent natural fires. Chapman (1952) discusses the differing tolerances and needs of pines for fire, and the ranges of the various southern pine species reflect the general pattern of intensity of electrical storm activity.

Away from the coastal plain, pine forests and Red-cockaded Woodpeckers in wilderness areas may be perpetuated even with limited fire suppression (e.g. McCurtain County Wilderness Area, Oklahoma; Wood and Lewis 1977). In such areas, the steepness of some slopes assures that hardwoods will not reach the lower branches of some pines and that some pine regeneration can occur. Fire is likely a necessary component of these pine ecosystems, although needed with lesser frequency. Elimination or extensive suppression of fire from such areas could result in the loss of Red-cockaded Woodpecker populations as pine reproductive success decreases following closure of forest canopies. Jackson et al. (1976) noted such problems on the Daniel Boone National Forest, Kentucky, and Wood and Lewis (1977) suggested that subtle vegetative changes may be resulting from the limited fire suppression efforts in the McCurtain Area.

Southern Pine Beetles and Red-cockaded Woodpeckers

Just as the pines and fire are characteristic of the Red-cockaded Woodpecker's environment, so too is the southern pine beetle. Southern pine beetles and their larvae are regularly eaten by Red-cockaded Woodpeckers (JJ, pers. observ.),

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although they are apparently not an especially significant food resource. However, the southern pine beetle has been of increasing concern to forest managers of the Southeast (e.g., Hedden 1978) and has been a problem in Red-cockaded Woodpecker colonies (e.g., Nicholson 1980, pers. observ. JJ, RC, BJ). These beetles have wrought extensive destruction in some southern wilderness areas and areas under consideration for wilderness status. Their control in these areas has been the subject of considerable controversy (e.g., Warren 1985). We will here limit our discussion to the habitats favored by the southern pine beetle, historical factors that have facilitated massive destruction by the beetles in wilderness areas, and the relationships between the beetles and the Red-cockaded Woodpecker.

Hedden and Billings (1979), Ku et al. (1980), Lorio (1980), and others have documented site and stand conditions associated with southern pine beetle infestations to include slower growing trees stressed by overcrowding, lightning strike, and logging activities. Pine beetle sites also had a higher pine/hardwood ratio and less understory. Thatcher et al. (1982) noted that the southern pine beetle "prefers pure pine stands" and that "a mixture of pine and hardwood species reduces the potential" for infestations. Hicks et al. (1981) also found that pines in low, wet sites were more associated with southern pine beetle attack than were pines on better drained sites.

Gara and Coster (1968) found that 5.5 m (18 feet) was the

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maximum distance over which infestations were able to spread from tree to tree and concluded that expansion of a local infestation was unlikely when average tree spacing was 6.1-7.6 m (20-25 feet). These results were reaffirmed by those of Johnson and Coster (1978), but they also noted that tree spacing was less critical when the beetles are colonizing trees rapidly. These and numerous other studies have demonstrated that high densities of pines - in excess of 44 square meters/ha (150 square feet/acre) - are conducive to the development of southern pine beetle infestations. In contrast, the Red-cockaded Woodpecker shows a strong preference for low pine basal areas - averaging between 11.7 and 17.5 square meters/ha (40 and 60 square feet/acre) (JJ, pers. observ.; Thompson and Baker 1971). Lennartz et al. (1983a) include a wider range of basal areas, and DeLotelle et al. (1983) much lower basal areas for active Red-cockaded Woodpecker colonies, but in our experience their extremes represent suboptimal habitat for the birds. Because of a lack of fire, high basal area pine stands exist on many of the southern wilderness areas today, providing marginal or poor habitat for Red-cockaded Woodpeckers and prime habitat for southern pine beetles.

Prehistoric pine forests in the South most preferred by Red-cockaded Woodpeckers were probably low basal area (in the range of 11.7-17.5 square meters/ha) pine stands on drier sites. At least longleaf pine habitats were likely maintained by intense summer fires. Such open stands, if present in

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abundance, were probably less vulnerable than modern forests to southern pine beetles. Southern pine beetle attacks undoubtedly still occurred, but were more restricted to small pockets of loblolly or other pines that were densely packed in small, moist transition zones between longleaf on dry uplands and the hardwood bottoms (Coulson et al. 1983). These small southern pine beetle spots probably served as a food source for Red-cockaded and other woodpeckers (Kroll and Fleet 1979).

There are probably fewer than 100 active Red-cockaded Woodpecker colonies on all wilderness areas (Table 1), and many of these colonies exist in areas of low basal area longleaf pine. Management in wilderness areas relative to Red-cockaded Woodpeckers and southern pine beetles should involve crisis prevention strategies rather than crisis treatment strategies (Stark 1979). This should include prescribed fire and, where necessary, an initial thinning to reduce high basal areas. Since tree damage resulting from use of heavy equipment can increase stand susceptibility to southern pine beetle infestation, we recommend the use of helicopters during thinning operations near active colonies. Any thinning activities should be accomplished outside of the woodpeckers' breeding season (approx. March-July). Following such initial treatment, low basal areas should be maintained by natural or prescribed summer fire as needed.

We suggest that cavity tree protection from beetles in vulnerable areas should only be considered a viable option as a

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last resort, and then only for active woodpecker colonies with a high basal area (> 32 square m/ha [110 square ft/acre]). The sole purpose of this minimal control should be to prevent extirpation of Red-cockaded Woodpeckers in wilderness areas so that a population is available to recolonize the fire-climax pine ecosystem when it is restored. Use of any beetle control technique should be based on its statistically proven effectiveness and a proven lack of negative impact on the woodpecker. The probability of successful beetle control must be weighed against a high probability of colony abandonment by Red-cockaded Woodpeckers if the beetle management involves cutting of mature pines which might serve for cavity excavation and as prime foraging habitat. Such cutting might also isolate cavity trees, making them more vulnerable to windthrow or lightning strike. Any beetle control efforts during the Red-cockaded Woodpecker's breeding season would have the greatest risk of causing colony abandonment or loss of a year's reproductive effort.

Alternative control measures for southern pine beetle infestation may soon be available. These control techniques use pheromones to alter beetle invasion behavior (Payne and Richerson 1985). If used when beetle spots on wilderness are still small (< 30 trees), pheromone control may be very effective. The pheromone "verbenone" is the chemical signal released by southern pine beetles when a tree is "full" of infesting adults and as such inhibits attack by other adult

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beetles. Application of verbenone to a buffer of healthy trees where southern pine beetles are advancing may inhibit the progression of the infestation. At the same time, a small application of "frontalure," a pheromone attractant for the southern pine beetle (Billings et al. 1981, Payne et al. 1985), to dead pines behind that advancing infestation may further depress the progression of an infestation by luring the beetles away from the verbenone treated live trees to already dead pines (Richerson et al. 1980, Billings et al. 1981, Payne et al. 1985). The use of pheromones to control beetle spots around Red-cockaded Woodpecker colonies as well as other places in wilderness and natural areas follows the concept of minimal control more than any cutting technique and would leave little or no evidence of human intervention. When and if pheromone control techniques become available, they would be the best beetle control measure to use in wilderness areas because they create the least habitat disturbance, could be used during the Red-cockaded Woodpecker's breeding season, and do not require that pines be cut.

The entomological data have told us that the beetles are a problem in even-aged, high density, stressed stands. Fire has been excluded for intervals that are too long on many southern wilderness areas. Fire under a natural regime would have thinned both pines and hardwoods, opening up the forest to create better habitat for Red-cockaded Woodpeckers and exerting some preventative control on beetle populations. Problems with

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beetles on wilderness areas can be greatly reduced if we restore fire, with the frequency and time of its occurrence under primeval conditions, to those portions of wilderness areas that would have naturally supported fire climax ecosystems.

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ATTACHMENT 2:

Table 1. Distribution and status of Red-cockaded Woodpecker colonies on wilderness areas in the southeastern United States

Wilderness Area	No. of Colonies active	inactive	unknown	Area of Wilderness (ha)
U.S. FOREST SERVICE				
Alabama				
Sipsey		4		7,766
Kentucky				
Daniel Boone NF	1	1	0	7,248
Louisiana				
Kisatchie Hills			14	3,521
South Carolina				
Francis Marion-Sumter	1	3		6,873
Texas				
Upland Island	3	3		4,856
Indian Mound			1	1,214
Little Lake Creek			12	4,025
Big Slough			1	1,619
U.S. FISH AND WILDLIFE SERVICE				
Georgia				
Okefenokee National Wildlife Refuge			26+	143,254
STATE				
Oklahoma				
McCurtain (Wood and Lewis 1977)	29			5,701

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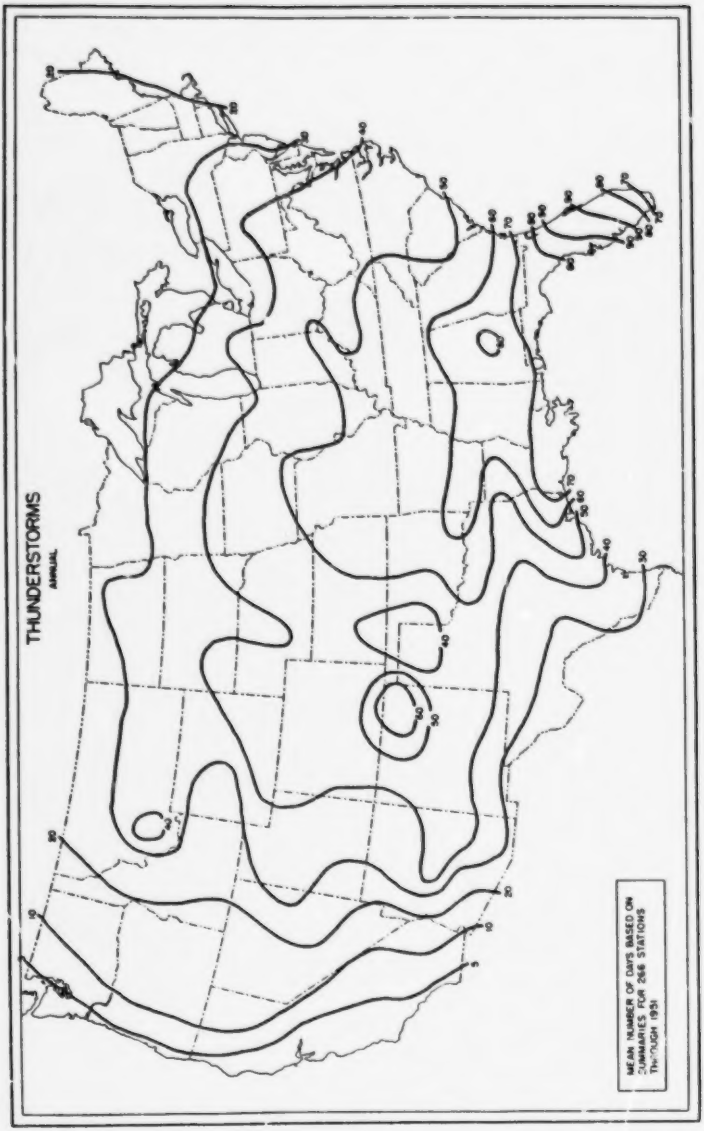

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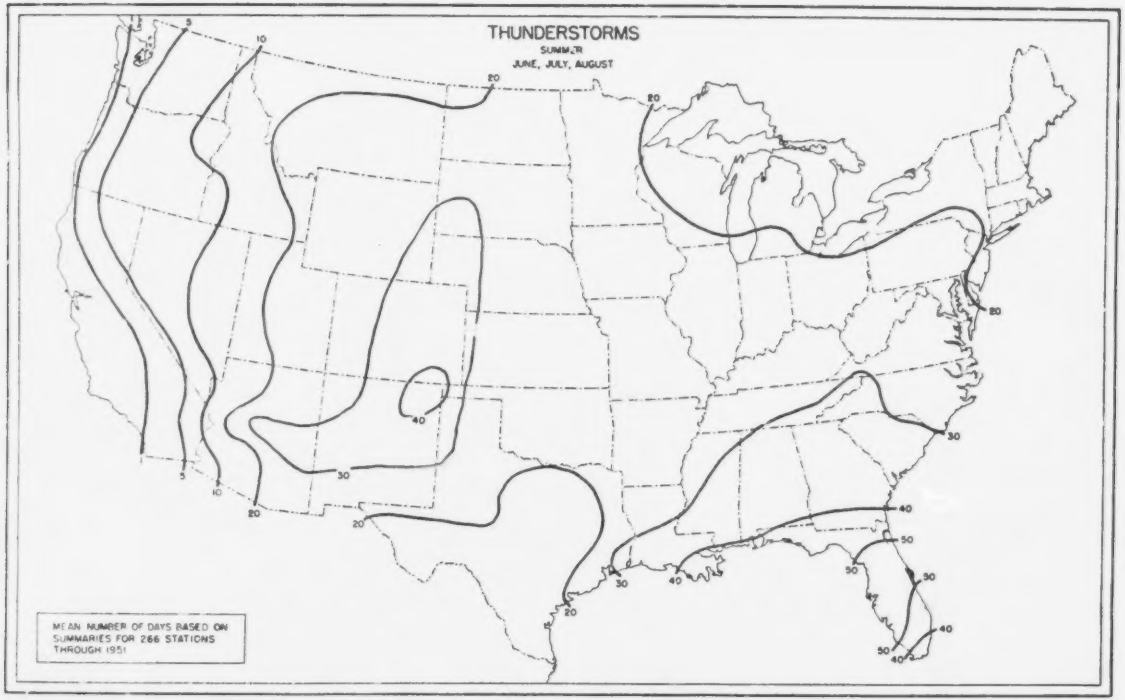

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Testimony - Committee on Interior and Insular Affairs, Subcommittee on Public Lands, U.S. House of Representatives, Washington, D.C. - March 18, 1986

My name is David L. Wood. I am a professor of entomology and Chairman of the Department of Entomological Sciences, University of California, Berkeley, California. My field of specialization is forest entomology. I have taught forest entomology, forest pest management and concepts of forest entomology to various classes of both undergraduate and graduate students during the past 25 years while at the University of California. Since 1955, I have conducted basic and applied research on bark beetles and during this period I have authored or coauthored over 100 scientific papers, most of which treat bark beetle biology and control. I hold a B.S. degree in forestry from the College of Environmental Science and Forestry, State University of New York, Syracuse, NY, and a Ph.D. degree in Entomology from the University of California, Berkeley, CA. Further details about my background are included in my curriculum vitae which I submit for your consideration.

I am familiar with the biology of the southern pine beetle through reading published papers, many visits to the southern U.S., close working relationships with scientists working on this insect, and as a member of the Technical Committee for the first 5-year Expanded Southern Pine Beetle Research and Development Program which was funded by the U.S. Department of Agriculture in 1974.

The following is my assessment of the appropriateness of the "cut-and-leave" method to control the southern pine beetle. I would like to quote from a chapter which I coauthored with four other scientists. The chapter is titled, "Treatment Tactics and Strategies," and is published in the book titled, "Integrated Pest Management in Pine-Bark Beetle Ecosystems," edited by W.E. Waters, R.W. Stark and D.L. Wood and published in 1985. This chapter is submitted for your further consideration.

"Whether considering stand treatments or pest population treatments we must:

1. Determine the effects of the treatment on tree mortality caused by bark beetles and on other stand attributes, such as density, age-size distributions, and species composition.

2. Determine the effects of the treatment on bark beetle population dynamics such as density, trend in density, spatial distribution, quality of post-treatment populations, and rates of parasitism, predation, and disease.

3. Determine how and to what degree changes in the stand attributes due to bark beetle-caused tree mortality with and without treatment(s) affect productivity and values of forest stands.

4. Determine the cost and safety (including effects on other organisms and interrelationships among them) of the treatment.

5. Conduct benefit-cost analyses.

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"Generally the benefits to be derived from pest population treatments are related directly to the time span for realization of the benefits, for example, to timber harvest, or any other point in time dictated by management objectives.

"Treatments aimed directly at killing the insect in infested trees have included almost every imaginable technique. Some of them are burning, peeling, solar radiation, burying, removal of infested logs from the forest, trap trees, electrocution, radio waves, bait and light traps, and submerging in water. Methods developed during wartime, for example, flame throwers and detonating cord, have been used to kill beetles in standing trees. Even sterilization by ionizing radiation and chemicals have been investigated. Insecticides applied on the tree before or after attack or injected into living trees have received the most attention. Herbicides have been injected into living trees to kill the offspring of attacking beetles. More environmentally acceptable methods such as uses of the fungus Beauveria bassiana, insect growth regulators, cut-and-leave or cut-and-top infested host trees, and behavior-modifying chemicals such as pheromones and pine oil, a by-product of sulfate wood pulping, have been investigated since the 1960s.

"Miller and Keen observed in their summary of early research on the WPB that "Direct control measures aimed at killing beetle populations have been quite fully explored and applied over vast areas for many years....However, all results from applied control indicate that the killing of beetles, no matter by what method, has only a limited effect in reducing tree mortality." Twenty years later, Billings concluded that "...direct control options (for SPB) currently available to the land manager remain few and relatively unchanged from previous years." In spite of this conclusion, such treatments as salvage removal, cut-and-leave, chemical control, and pile-and-burn are recommended for control of SPB in localized areas. Although these methods remove or kill beetles in such areas, the efficacy of these methods in lowering tree mortality over larger areas is essentially unknown.

"Coulson and Stark conclude that "...unfortunately, efficacy for most of the tactics (i.e. remedial procedures) could not be critically investigated. Inadequate sampling and estimation procedures precluded field measurements of proposed modes of action and their efficacy.... It was not possible to separate extraneous sources of variation from the field tests."

"In eastern Texas during 1974, about 3000 spots (10 adjacent trees infested with the southern pine beetle) were treated by salvage, cut-and-leave, and other methods. Spots were located by aerial sketch-mapping. An analysis of spot proliferation in a 245-ha (605 acres) area around each treated spot revealed (1) a short-term reduction in the number of new spots treated by salvage and cut-and-leave during the summer months, (2) an increase around spots treated by all methods after September, and (3) an increase near active spots where no treatment was conducted."

Treatments such as "cut and leave" which are aimed at bark beetles while they are present in the tree or while they are attacking new trees in the immediate vicinity of infested trees are the most difficult to execute. The reasons for this are:

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1. Infested trees must be detected prior to the emergence of the parent and new brood adults. Aerial surveys detect trees with needles that have changed color from the normal green to yellow and red. Beetles have emerged from trees that have turned yellow in color. Certainly parent adults will have emerged while the foliage is green. Thus trees with normal green foliage may be infested.

2. Species of bark beetles that produce many generations each year require frequent aerial surveys to detect recently infested trees. Therefore treatments aimed at populations of beetles in trees must be conducted rapidly in order to inflict maximum mortality before the beetles leave the trees. As groups of infested trees (spots) increase in size there is almost a continuous availability of beetles to kill trees. As the season progresses the generations overlap one another. Thus parent adults from one generation become mixed with brood adults from both earlier and later generations.

3. The logistics of visiting groups of infested trees in a timely manner and over a sufficiently large enough area means that only a small proportion of the beetles will be killed through direct control treatments such as "cut-and-leave." Consider only a three-step process where one is 90% successful at each step. For example, 90% success in detecting infested trees from aerial surveys, 90% success in visiting infested trees over an area of sufficient size to take into account the flight range of the insect (one to several square miles), and 90% effectiveness in treating each tree (e.g. "cut and leave," insecticide, attractants, etc.) Thus 90 x 90 x 90 gives us 73% effectiveness in killing beetles in the area of concern. Of course this is a ridiculously high estimate because we know that there are many more steps required and that we are not at all 90% effective in any of these operational steps. Most entomologists will agree that greater than 95-98% mortality is required to prevent an increase in the population.

Taking into account these serious biological and operational constraints, I cannot support the use of "cut-and-leave" as a treatment tactic for use against southern pine beetle. Efficacy of this method has not been established experimentally. In order to accomplish this, evaluation of tree mortality in and near groups of treated trees (so-called spot growth) and in areas between groups of infested trees (called spot initiation) is required. Thus, it is not sufficient to judge efficacy of the treatment by evaluating spot growth alone. One can speculate that one of the outcomes of treating spots by the "cut-and-leave" method is an increase in the number of new spots at some distance from the treated spot. Since to my knowledge, there are no estimates of mortality of bark beetles caused by this treatment method, there is no scientific basis for the treatment. Furthermore, to my knowledge no replicated study has been conducted where tree mortality in treated areas before, during and after the treatment was compared to tree mortality in areas where no treatment was applied. Thus the "cut-and-leave" treatment described in the publication authored by K.M. Swain, Sr. and M.C. Remion entitled, "Direct Control Methods for the Southern Pine Beetle," U.S. Department of Agriculture Handbook No. 575, published in 1981 is not supported by evidence from controlled experiments. I have submitted this publication for your further consideration. The recommendation to cut a strip of living trees 40 to 70 ft wide around most active spots and a strip 100 ft wide around large spots

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sacrifices living trees that may not have been killed by the southern pine beetles. Such a treatment tactic can be compared to the medical practice of removing tonsils and appendixes to prevent infection and possible death of healthy patients.

Swain and Remion further state that "...the cut-and-leave method was first recommended by the Texas Forest Service for controlling small spots (10 to 50 infested trees) that could not be salvaged. Thus techniques involve felling infested trees and a buffer of uninfested trees and leaving them in the woods. The treatment disrupts spot growth and causes emerging adults to disperse into the surrounding forest." Apart from the fact that we do not know what happens to the beetles under these treatment conditions, I have serious doubts about employing such a treatment to prevent the spread of beetles to adjacent forested areas whether they be wilderness or private ownerships. Indeed, G.E. Moore and colleagues have shown that southern pine beetles tagged with a radioactive isotope (32 phosphorus) were found in fresh pitch tubes 1100 ft away from infested trees. The paper is titled "Tracing dispersion of southern pine beetles from felled brood trees with phosphorus 32" and was published in 1979 in the Journal of the Georgia Entomological Society, Vol. 14, pp. 84-87. I submit this paper for your further consideration. Thus at the minimum we can expect southern pine beetles to disperse over 364 meters from an infested tree.

As we state in our 1985 chapter, "Experiments with treatments also have had a major deficiency, lack of replication. Without sufficient replication, one cannot separate treatment effects from the effects caused by natural control agents, nor can the relative effectiveness of different treatment combinations be evaluated. Also, treatments generally have not been applied and evaluated over a sufficiently large area to account for the movement of beetles into and out of the treated area. It is insufficient to evaluate efficacy of a pest population treatment from treatment only of a few trees or groups of trees."

In conclusion, until resource managers such as the U.S. Forest Service and state agencies responsible for control of bark beetles understand what is needed to demonstrate treatment efficacy, the needed research will continue to be postponed. Until experimentally proven treatments can be provided, the resource manager must decide whether the risk of using such treatments is worthwhile.

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Statement of William E. Waters for Oversight Hearing of the Subcommittee on Public Lands, Committee on Interior and Insular Affairs, U.S. House of Representatives, on Control of Southern Pine Beetle Infestations in the Southeastern United States, March 18, 1986, Washington, D.C.

My name is William E. Waters. I am Professor of Entomology and Forestry and Forest Entomologist in the Agricultural Experiment Station, University of California, Berkeley. A brief summary of my education, professional experience, and relevant professional activities is attached.

I wish to address the issue of the scientific basis for use of tree harvesting as a means of controlling southern pine beetle infestations, and in particular the use of this tactic in wilderness areas as a means of protecting timber on adjacent lands, by first outlining the kind of research needed to develop sound methodology for direct control of any destructive forest insect. I will then comment on certain voids and shortcomings in this scientific process, as it applies to the southern pine beetle, that place considerable doubt on the effectiveness and reliability of tree harvesting for control of this insect.

There are three steps or phases in the process:

I. Laboratory Studies and Experiments

This includes studies of certain aspects of basic biology and behavior of the insect that can be carried out in a laboratory setting. It also includes experimentation with chemicals or other treatment possibilities, such as sterilization by radiation. With chemicals, this means the isolation,

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identification, and synthesis of biologically active compounds, i.e., compounds that act as toxicants, attractants, repellents, etc., and the screening of candidate compounds to select those having greatest potential for field testing.

Research of this sort -- spanning 50 years or more -- has provided much information on the genetics, physiology, pathology, and behavioral mechanisms of the southern pine beetle that is essential for the development of direct control treatments. (Thatcher, R.C., J.L. Searcy, J.E. Coster, and G.D. Hertel (eds.). 1980. The Southern Pine Beetle. USDA Forest Serv. - Sci. and Educ. Admin. Tech. Bull. 1631; Waters, W.E., R.W. Stark, and D.L. Wood (eds.). 1985. Integrated Pest Management in Pine-Bark Beetle Ecosystems. John Wiley & Sons, New York)

II. Field Studies and Experiments

This phase includes studies of all aspects of the biology, behavior, and population dynamics of the insect under natural forest conditions -- life history, natural enemies, interactions with host trees, and dispersal, for example. This information is the basic ingredient in developing control strategies and tactics. It provides the foundation and framework for the field testing of alternative treatments and, importantly, for the development of sound criteria for evaluating treatment effectiveness. With respect to the southern pine beetle, research at this level -- particularly in the last 15 years -- has provided a rich background of information. (Thatcher, R.C., J.L. Searcy, J.E. Coster, and G.D. Hertel (eds.). 1980. The Southern Pine Beetle. USDA Forest Serv. - Sci. and Educ. Admin. Tech. Bull. 1631; Waters, W.E., R.W. Stark, and D.L. Wood (eds.). 1985. Integrated Pest Management in

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Pine-Bark Beetle Ecosystems. John Wiley & Sons, New York) There is one notable void, however, that relates directly to the rationale for controlling southern pine beetle infestations on a spot-by-spot basis to prevent tree mortality on adjoining lands, and the question of actual efficacy of the tree harvesting techniques presently used by the Forest Service in this situation. We lack vital information on the dispersal behavior and capabilities of the beetle. We know that time of year, weather, forest stand conditions, terrain, and beetle population density all affect direction and distance of beetle flight. We do not know how all of these factors interact in particular situations throughout the insect's range. Thus, our ability to predict the rate of enlargement of individual spot infestations and the occurrence of new spots at any given time and location is limited. It seems evident, also, that the use of a particular harvesting technique, including the cutting of a buffer strip of uninfested trees 100 feet or less in width around an active spot infestation (see Swain, K.M., Sr. and M.C. Remion. 1981. Direct Control Methods for the Southern Pine Beetle. USDA Combined Forest Pest Research and Development Program, Agr. Handb. 575) is not likely to be effective in all situations.

For any method of treatment for direct control of a pest insect, there are a number of variables that determine treatment effectiveness. With insecticidal chemicals, for example, this includes the toxicity of the chemical, type of formulation, concentration, method of application, application rate, timing with respect to development and behavior of the target insect, etc. Microbial insecticides and behavior-modifying chemicals have similar, but somewhat unique, variables that determine their effectiveness. The use of tree harvesting for direct control involves a quite different set of treatment variables that are more or less pest-specific. Whatever the method of treatment, carefully designed field experiments are needed to find what is the most

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effective treatment combination over a representative range of pest and forest conditions. And best is not enough. Field experiments are needed also to determine what, if any, treatment combinations meet a specified level of satisfactory performance.

With tree harvesting strategies for direct control of southern pine beetle in spot infestations -- the cut-and-leave method, for example -- the treatment variables include timing, condition of trees to be cut, and size of buffer strip, each with several levels of treatment intensity. And then there are the site, stand, and beetle population conditions to be accounted for -- e.g., landform, stand age and density, spot size, and beetle population level. The effect of these variables on efficacy of treatment must be included in any analysis in order to determine just how reliable and consistent this method of control really is. Or, putting it another way, under just what conditions will the cut-and-leave method meet the standard of performance specified as acceptable.

The magnitude of the task of designing and conducting a field experiment that can adequately measure the effects of treatment and critical environmental variables on a realistically comprehensive scale is compounded by the need for replication of all treatment combinations. Depending on the number of treatment combinations, environmental variables, and replications, the size of experiment can quickly become quite large. For example, suppose we design a simple cut-and-leave experiment involving the harvesting of all infested trees in 3 size classes of spots at 3 different times of the year, and include the cutting of infested trees in 2 widths of buffer zone in the experimental design. This means we would have $3 \times 3 \times 2 = 18$ treatment combinations, which would require 18 individual spot infestations for a single representation, or

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replicate, of each. In order to analyze the data from this experiment statistically, we need at least 2 replicates of each treatment combination, or 36 individual infestations. Given the number of other factors that are not included in the design of this experiment, we probably would be well advised to have 3, 4, or 5 replicates of the treatment combinations that are included in order to have some assurance that we can detect any signicicant differences in effectiveness among them -- calling for 54, 72, or 90 individual infestations in the experiment. To my knowledge no field experiment of this magnitude — as basically simple as it is -- has yet been conducted of the cut-and-leave method for direct control of the southern pine beetle.

Many field trials of this method -- as well as the salvage method -- have been conducted in east Texas and elsewhere in the South at different times of year and under a variety of infestation conditions -- essentially without any experimental design (e.g., see Billings, R.F. and H.A. Pase III. 1979. Spot proliferation patterns as a measure of the area-wide effectiveness of southern pine beetle control tactics, in J.E. Coster and J.L. Searcy (eds.), Evaluating Control Tactics for the Southern Pine Beetle. USDA Forest Serv. Tech. Bull 1613, pp. 86-97). The results have been evaluated in terms both of spot enlargement and spot proliferation. Methods of sampling and monitoring infestations before and after treatment have varied (see Coster, J.E. and J.L. Searcy (eds.) 1979. Evaluating Control Tactics for the Southern Pine Beetle. USDA Forest Serv. Bull. 1613). And in many cases of apparent success, it has not been really clear whether this was due to the treatment or to the natural subsidence of beetle activity due to weather or other factors. This conglomerate of shotgun testing has resulted in a wide range of views as to the efficacy of these harvesting techniques and, in my opinion, has not provided scientifically sound evidence for their operational use.

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III. Pilot Tests

This phase includes the field testing of selected treatments under operational conditions. It is an essential step that is required to confirm the efficacy of a particular treatment, or to compare the efficacy of two treatments, when carried out in a practical way on an operational scale. Pilot tests are the place also to work out details of field procedure to be followed in practice. They too have to be carefully designed, and monitored as carefully as field experiments. They must be adequately replicated to provide a reliable basis for evaluation of efficacy. The basic question to be answered is does the treatment(s) achieve its purposes, i.e., does it meet the specified level of satisfactory performance in terms of both pest population suppression and reduction in tree mortality. The added requirement of pilot tests is that they be monitored for a sufficiently long period to determine the duration of effectiveness of the treatment(s). This bit of information is needed to estimate cost effectiveness and provide the basis for future planning.

Much of the field testing of harvesting techniques to control southern pine beetle can be characterized as a mix of trial-and-error experimentation and pilot testing. Expectations and specifications of what constitutes satisfactory performance have varied. And results have varied, with insufficient evidence generally to fully explain either success or failure.

In my opinion, this critical phase of research and development for direct control of the southern pine beetle by harvesting techniques has not been conceived and conducted adequately to provide answers to the basic operational

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questions. In particular, we do not yet know what effect the treatment of spot infestations has on beetle dispersal and attack behavior on an area-wide basis.

Summary

Because of the volatile population dynamics of the southern pine beetle, uncertainties as to the reliability and consistency of effectiveness of spot treatments, and lack of evidence of area-wide effectiveness, operational use of the salvage removal and cut-and-leave techniques to either control this insect in a given area or to protect other areas not presently infested cannot be justified scientifically.

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Testimony - Subcommittee on Public Lands, Committee on Interior & Insular Affairs, U.S. House of Representatives, Washington D.C., March 18, 1986.

My name is Kenneth Q. Lindahl, Jr. I am a candidate for the Ph.D. degree in the Biostatistics Program, and a Senior Systems Analyst employed by the Academic Computing Services unit at the University of California, Berkeley, California. I hold a B.S. degree in Biological Science and an A.B. degree in Mathematics from the University of California, Irvine, California. Further details about my education and professional experience are included in my curriculum vitae which I submit for your consideration.

I am familiar with the issues of field experimentation with bark beetles through ten years of collaboration with David L. Wood, Professor of Entomology, University of California, Berkeley, California. I am currently working on a Ph.D. dissertation which involves the development of statistical techniques for evaluating the effects of a large-scale trapping program to control the western pine beetle. I am familiar with the published papers describing research funded by the Expanded Southern Pine Beetle Research and Development Program.

I would like to address the experimental design issues relevant to the pilot test phase of determining the efficacy of timber harvesting as a method to control the southern pine beetle. The discussion of experimental design issues falls into two nearly distinct parts, namely:

(i) issues involved in choosing the treatments to be compared, the experimental units to be used, and the observations to be made (that is, the

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specific quantities to be measured); and

(ii) issues involved in assigning treatments to experimental units and deciding how many units should be used (sample size).

(Cox, D.R., 1958. *Planning of Experiments*.) This distinction is based on the fact that the issues in (i) are technical issues specific to the subject matter of the experiment, in this case timber harvesting to control southern pine beetle, whereas the issues in (ii) are statistical issues which must be addressed in almost all experimental designs, regardless of subject matter.

The choice of treatments for a pilot test tends to be straightforward: pilot tests usually consist of a single experimental treatment, selected and "fine-tuned" during the preceding field experimentation phase of research, and a check, that is, no treatment, against which to judge the effect of the experimental treatment. Please note that I am using the term "check" to refer to what statisticians usually call the "control" or "control treatment." I am doing this to avoid confusion with the term "control" as applied to the southern pine beetle. The check is essential to pilot testing control methods for the southern pine beetle: without a valid check, it is impossible to ascribe any observed effects to the treatment as opposed to changes which would have occurred even in the absence of the treatment. Thus, applying a timber harvesting treatment to southern pine beetle infestations and observing a subsequent reduction in tree mortality is not sufficient since it is possible that tree mortality would have declined naturally during and after the test period. Observations on the check provide a measure of natural changes in tree mortality, against which any treatment-caused changes will be clearly identifiable. A valid check for such a pilot test would consist of exactly the same field activities as the treatment, with the exception of the actual timber

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harvesting. In particular, monitoring procedures for the check should be identical to those for the treatment, and should be done during the same time period.

Choosing experimental units in a pilot test of timber harvesting to control southern pine beetles involves the specification of regions or "plots" to receive the treatment and check. Three principles affect the choice of experimental units: First, the units must be an appropriate size. The plots must be large because southern pine beetles are highly motile and the effects of the treatment may extend a considerable distance beyond the boundaries of the harvested region. The cut-and-leave method is described in *Direct Control Methods for the Southern Pine Beetle*, by K.M. Swaine, Sr. and H.C. Remion, 1981, Agriculture Handbook No. 575, United States Department of Agriculture. (This publication has been submitted by D.L. Wood for your consideration.) The authors stat . "The treatment disrupts spot growth and causes emerging adults to disperse into the surrounding forest." Thus, the plots must be large enough to allow the detection and measurement of any new spots which develop as a result of southern pine beetle dispersal. I would suggest that the plots be centered around the spot targetted for timber harvesting, and extend in all directions for a distance no less than the maximum flight distance of southern pine beetles. Second, the experimental units must respond independently to the treatment. That is, the plots must be far apart so that the effects of the treatment in one plot cannot influence another plot. For example, the development of a new spot as a result of the treatment could attract beetles away from nearby plots. In this regard, I suggest that plots be separated by a distance of at least twice the maximum flight distance. Third, the experimental units must be representative of a realistic and practical range of conditions. If this is not the case, the results of the pilot test may not be

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applicable to the entire range of conditions under which the treatment is to be used operationally. For example, if all the plots were located in stands with low tree densities, the results probably could not be extrapolated confidently to other stands with higher densities. To avoid this shortcoming, plots should be chosen to represent a realistic range of densities. In addition to tree density, other conditions for which plots should be representative include stand age, stand species composition, spot size, spot density, beetle population levels, and season.

The primary observations to be made in a pilot test of timber harvesting to control southern pine beetle are concerned with tree mortality; specifically, the number of trees killed by beetles before, during, and after timber harvesting. The comparison of tree mortality in the treatment plots with that in the check plots is an essential component in the evaluation of efficacy of any control method for the southern pine beetle. Additionally, observations on stand attributes, including density, age, and species composition, may be necessary. As discussed in "Treatment Tactics and Strategies" by D.L. Wood et al, a chapter in the book titled *Integrated Pest Management in Pine-Bark Beetle Ecosystems*, edited by W.E. Waters, R.W. Stark and D.L. Wood, 1985, it is necessary to ~~the~~ determine how changes in stand attributes, resulting from treatment effects on bark beetle-caused tree mortality affect productivity and values of forest stands. (This chapter has been submitted by D.L. Wood for your consideration.)

I turn now to the second set of issues, those concerned with the assignment of treatments to experimental units and the determination of how many units to use.

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In assigning treatments to experimental units, systematic differences between units receiving the treatment and units receiving the check must be avoided. If such systematic differences are present in a pilot test, they will be inseparable from any treatment effects, when the treatment is compared to the check. Such a comparison is said to be biased. Randomization techniques are employed to minimize the possibility of systematic differences. The essential feature of randomization is that treatment and check are assigned to experimental units by an objective, impersonal procedure. It is thus impossible for the experimenter to subconsciously introduce systematic differences into the comparison. Randomization is most often done using "random number tables," which are tables of digit sequences, usually computer generated, in apparently random order. As a rather trivial example, in an experiment with just two experimental units, I might number them "1" and "2," then referring to a random number table, I would assign the treatment to whichever unit whose number I encountered first in the table. Of course, I could just as easily have tossed a (fair) coin, which most people would find more satisfactory than reading a table of 10,000 random digits, but from a statistical viewpoint the two methods are equivalent.

There is another benefit of randomization which I will mention only briefly, namely, it is possible in a randomized test to determine exact significance tests and confidence intervals for the treatment effects. This is an area of statistics commonly known as "nonparametric statistics." These tests and confidence intervals may be contrasted with more frequently used techniques which involve assumptions, generally unverifiable, about the underlying statistical distributions of the experimental units.

The simplest form of randomized experiment is the case where half of the

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experimental units are randomly chosen to receive the treatment and the other half receive the check. There are more complicated forms of randomization that are designed to deal with more complex situations, for example, randomized block designs and stratified designs may be used in situations where experimental units can be divided into more homogeneous groups. While these more complicated designs may be appropriate for some pilot tests, generally a pilot test should be designed as simply as is reasonable.

Choosing the number of experimental units, that is the sample size, is a critical part of designing the pilot test. If the number chosen is too small, the results of the test may be inconclusive, rendering the pilot test useless. If the number chosen is too large, considerable effort and expense may be wasted obtaining a more precise estimate than is necessary. For this discussion, a precise estimate is one which shows little variation, that is, it is always close to the true value being estimated. Although sample size determination is relatively simple in principle, it is frequently difficult in practice. The precision with which the treatment effect is measured in an experiment is determined by the variability among the experimental units and by the number of experimental units. Therefore, if the experiment designer knows the magnitude of the variability among the units, a sample size sufficient for any desired degree of precision can be calculated. Unfortunately, the magnitude of the variability among the units usually is not known in advance of the pilot test, so that this operation is difficult to carry out. Estimates of the magnitude of variability may be available from the field experimentation phase or from previous pilot tests, but my experience with bark beetle field testing is that the magnitude of variability is itself highly variable from time to time and place to place. Without a reliable estimate of the magnitude of variability, the experiment designer must choose the number of experimental

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units based on general judgement.

In summary, a pilot test to establish the efficacy of timber harvesting as a method to control the southern pine beetle, in order to be scientifically valid, must adhere to the principles of experimental design. These principles include:

(1) use of a valid check for comparison;

(2) plots that are large enough to allow detection of treatment effects including the development of new spots, far enough apart that the treatment cannot affect other plots, and representative of a reasonable range of operating conditions;

(3) measurement of tree mortality and stand characteristics before, during, and after the treatment period;

(4) randomization of treatment and check to plots; and

(5) a sample large enough to assure reliable estimates of treatment effects.

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The Efficacy of Area-Wide Tactics for Controlling a Southern Pine Beetle Epidemic

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The two area-wide tactics that are most commonly used to control or curtail a southern pine beetle epidemic are salvage of the infested and dead timber and, in cases were salvage is not feasible, "cut-and-leave." In theory both tactics appear reasonable, however, there is little scientific data currently available to support or refute this. We do not know what impact either tactic has on the extent, duration, or intensity of a southern pine beetle epidemic. In some instances, at least, research studies can and should be implemented to determine the efficacy of these tactics on an area-wide basis.

Properly executed salvage operations do utilize the infested and dead trees before excessive deterioration of the wood occurs. Salvage operations also remove the southern pine beetle brood from the stand and thus reduce the likelihood of further spread of the spot infestation. When infestations do continue to spread, it is usually due to inexperienced ground crews misidentifying infested trees, or a delay in salvage after the trees to be cut have been marked. If enough salvage crews are put into an epidemic area, fast and correctly applied salvage operations should curtail a southern pine beetle epidemic. However, to my knowledge this idea has never been adequately tested. This would require both treatment and control areas for comparison. Furthermore, pulpwood and timber prices frequently make rapid salvage operations of some infestations uneconomical. The multiple ownership of private land in the South also presents a logistical problem. Therefore, the salvage operations that do take place utilize the timber and remove some beetle. from the st.nd,

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but may have little impact on the area-wide epidemic.

Cut-and-leave is a tactic that is frequently utilized when it is not feasible to salvage an infested stand because the spot is too small or inaccessible, or because the costs exceed the short-term benefits. In this case, the practice is to fell all the infested trees and a surrounding buffer of trees, toward the infestations center. Depending upon the time of year, the trees may or may not be toped (the crowns severed from the trunk). Theoretically this practice should do two things. First it should disrupt the microenvironment of the southern pine beetle brood and cause a reduction in brood development and emergence. Second, those brood that do survive and emerge should be unable to orient toward a standing infested tree that is emiting pheromone. Thus the emerging brood will disperse and there may be a high degree of mortality associated with that dispersal. However, the amount of mortality that is associated with dispersal is unknown. For this reason, the efficacy of the cut-and-leave tactic has never been adequately addressed. The tactic may simply cause a proliferation of infestations in the area. In fact, when the N. C. Forest Service utilized this technique in one area of the state, a number of additional infestations were detected after the treatment. As a result, the N. C. Forest Service does not recommend this tactic. It should be pointed out that this evaluation was not a scientifically designed experiment, and the increase in infestations could have been the result of other factors. Research results in the Gulf Coast have shown that the individual infestations are controlled (no further spread occurs), and there is some indication that spot proliferation may be reduced after summer treatments. But brood survival in the treated trees can be substantial. Under epidemic conditions with very high beetle populations, this tactic may have only marginal value on an area-wide basis. Because of high numbers, sufficient beetles may survive the treatment and the subsequent dispersal flight to creat additional infestations.

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Neither tactic is likely to succeed in reducing an epidemic unless applied with great intensity. The rapid treatment of infested areas should reduce tree mortality, but the scientifically acquired data to support this is scarce. Research programs that evaluate the efficacy of both treatment tactics on an area-wide basis should be funded. In addition, high priority should be given to the evaluation of these tactics as well as other silvicultural treatments during periods of low southern pine beetle activity. It is my belief that the most promising means of controlling southern pine beetles is to minimize the probability of an epidemic's initiation. Thinning of densely stocked stands, maintenance of mixed pine/hardwood stands (especially in wilderness areas), rapid utilization of larger spot infestations, and rapid treatment of small infestations (perhaps by cut-and-leave, a pheromone trapping treatment, or a combination of both) should provide ample measures for maintaining populations at low levels. Based upon scientific and observational information I feel confident with the reliability of each of the above treatments except the treatment of small infestations. The cut-and-leave and pheromone trapping strategies clearly need additional research. Under low level conditions, these tactics may prove to be quite useful. Under epidemic conditions there utility may be severely limited.

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Testimony of Dr. Thomas F. Mueller

before the Subcommittee on Public Lands

of the Committee on Interior and Insular Affairs

of the United States House of Representatives

March 18, 1986

AGRICULTURAL & ENVIRONMENTAL SCIENCES PROGRAM

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Mr Chairman, Congressmen and Congresswomen, I am Dr. Thomas F. Mueller. I am pleased to have been invited to testify before you on this important issue.

I am an Integrated Pest Management Specialist with the Texas Department of Agriculture. I have an undergraduate degree in biology from Princeton University, a master's degree in population biology from the University of California, and a PhD in ecology and evolution from the State University of New York at Stony Brook. My areas of specialization are insect/plant relationships and insect pest management.

The Texas Department of Agriculture is concerned both with the loss of valuable forest resources caused by the Southern Pine Beetle and with the impact of Southern Pine Beetle control measures on Wilderness areas. Solving the associated problems requires a hard look at the scientific data.

The continuing controversy over the use of direct control measures, salvage and cut-and-leave, to control the Southern Pine Beetle in Wilderness areas combines two major issues. The first concerns the actual effectiveness of direct control measures for controlling individual localized Southern Pine Beetle spot infestations and for managing SPB populations on an area wide basis. The second issue concerns the role of SPB in Wilderness areas.

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The most respected experts on SPB do not agree on the proven effectiveness of salvage and cut-and-leave techniques for control of the Southern Pine Beetle. The primary reason for this is a lack of definitive scientific evidence. The lack of evidence does not reflect a lack of effort, but rather the extreme difficulty of conducting replicated experiments with the necessary controls in a forest ecosystem.

Consequently, the best evaluations of direct control efficacy come from compilations of data on many spot infestations and generalized trends. Probably the best study of this sort was conducted by Billings and Pase and published in a 1979 US Forest Service Technical Bulletin entitled, Evaluating Control Tactics for the Southern Pine Beetle. The study by Billings and Pase considered most of the forest area of east Texas from January 1974 to June 1975. The authors examined the records of thousands of spot infestations with respect to the size of the spot, the stand class (tree age, basically), the control practices and time of year. However, the study was quite complicated and required numerous simplifying assumptions. Without going into great detail, the general conclusion was that salvage and cut-and-leave techniques apparently reduce the incidence of new spot infestations as long as these control measures were not used from October through December.

Direct control measures did not eliminate spot proliferation but rather the number of new spots observed was less than the number of new spots expected without control efforts. The maximum reduction in the number of observed new spots relative to expected new spots was about 45% for salvage

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measures conducted from January to May. Specifically, about 46 new spots were expected under these conditions but only 25 were observed. In other words, the salvage treatments conducted between January and May were about 45% effective in reducing the number of new spots. Based on these data, this is only a marginally effective control technique. Salvage operations were conducted on 24 spots between January and May 1974. During the subsequent interval of treatment effect from June 1974 to January 1975, 25 new peripheral spots were detected and presumably arose from the salvage control spots. This is more than one new spot for each salvage spot. I reiterate, this is not indicative of highly effective control. Furthermore, salvage conducted during June through September was less than 30% effective, and cut-and-leave operations were less effective yet.

Salvage operations conducted from October through December resulted in a 34% increase in observed new spots over the number expected indicating that salvage during this period actually acts to increase the number of new spot infestations more than if no control measures were taken at all.

The direct control tactics of salvage and cut-and-leave may reduce new spot proliferation of the Southern Pine Beetle marginally under the best conditions. But even if salvage operations were conducted on every SPB spot in east Texas between January and May it would not eradicate the pest or stop its spread. At best, it would slow the new spot proliferation by less than half. But of course it is not feasible to treat every SPB spot in this manner.

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Salvage and cut-and-leave may be the best direct control measures we have right now — but they are not very good from a pest management standpoint and clearly cannot solve the problem.

The bigger issue is whether direct control measures are effective at substantially reducing SPB populations over large areas. There is little, if any, evidence that direct control measures have ever suppressed beetle outbreaks over large areas.

Therefore, based on data presently available, direct control techniques are only marginally effective on a spot by spot basis and ineffective on an area wide basis.

The focus of this hearing is on the Texas Wilderness areas that comprise about 35,000 acres in east Texas. This is less than half of one percent of the estimated 12 million acres of forest in east Texas, so we are considering a very small area relative to the total forest acreage.

Now I would like to address the second issue; what role does the Southern Pine Beetle play in such Wilderness areas? To answer this question it is critical to understand the role of bark beetles in forest ecosystems. Let me quote from a book titled Integrated Pest Management in Pine-Bark Beetle Ecosystems published in 1985, a chapter written by Drs. Crookston and Stark.

"Therefore, if we assume conservatively that our pine forests became an entity 90 million years ago and their successional period is 300 years,

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then to date there have been about 300,000 turnovers of these forests. If we further assume that Dendroctonus bark beetles became distinct as a group 40 million years ago, that outbreaks begin when the forest reaches age 100 in each succession, and that subsequent outbreaks occur on the average of every 40 years, then a total of 1.5 million outbreaks would have occurred since bark beetles and pines began coevolving. Thus, there would have been at least ... 390 million generations of SPB in the most favorable parts of its range. Only in the past 200 years, have humans been imposing changes in bark beetle - forest ecosystems, causing unique conditions.
... In all cases, the primary ecological role of bark beetles is to remove selectively certain species and size classes of trees from mature, overmature and climax forests." pp. 83-85.

The Southern Pine Beetle is an integral part of the southern forest ecosystem and has been for millions of years. Within the context of the southern forest ecosystem, the SPB is a critical component. The natural southern forest ecosystem exists in a relatively stable climax state when viewed over a large area, but maintenance of this apparent stability is dependent upon localized changes in response to inevitable natural perturbations. By killing pines in pure, even-aged stands such as might result from a fire, the SPB increases the vigor of remaining pines and facilitates growth of the hardwood understory, thereby preserving the continuity of the ecosystem itself. Destructive efforts to control the Southern Pine Beetle in Wilderness areas do not benefit the Wilderness.

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Given these facts, the question is whether the value of direct control measures — salvage and cut-and-leave — justifies the destructive impact in Wilderness areas of the measures. Given the data presently available, we believe that the direct control measures are not justified. If further studies show the control measures to be more effective, the question could be looked at again.

Let me suggest two constructive alternatives to help solve this problem in the future. First, I propose a research project to determine the effect of direct control techniques on the Southern Pine Beetle in east Texas. The project will pair each of the 5 east Texas Wilderness areas with a very similar National Forest area. No SPB control measures will be used in the Wilderness areas and direct control measures salvage and cut-and-leave, will be used in the comparable National Forest areas. Periodic and systematic monitoring of SPB populations will be conducted in all areas to determine population density and distribution, spot growth and proliferation and timber losses. The purpose of the research is to:

(1) compare the impact of direct control techniques (i.e. salvage and cut-and-leave) and no control efforts on the population dynamics of SPB over relatively large areas.

(2) determine the efficacy of direct control methods on reducing the number, size, growth and proliferation of SPB spot infestations.

(3) quantify the economics of timber losses associated with SPB direct control techniques and no control efforts.

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The alternative proposal is to utilize SPB spot infestations in Wilderness areas for the development and testing of non-destructive control tactics. These tactics primarily involve the use of chemicals that either attract or repel Southern Pine Beetles. Some preliminary experimental work with these behavioral chemicals has yielded promising results but further testing is necessary.

Thank you for permitting me to testify on this issue.

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ATTACHMENT A:

SPB factors
Current population level and distribution
Recent SPB history
Recent SPB control measures (e.g. extent of cutting)
Current adjacent SPB populations

SPB and forest monitoring:

Periodic aerial photographic survey
(Spot detection, size, growth, proliferation, direction of spread natural die-out).

Ground surveys
Confirm accuracy of aerial surveys.
Evaluate SPB population composition, growth rate, and natural enemy complex.
Determine timber losses.
Quantify control activities, i.e. acreage and number of trees cut and salvaged.

Duration of study:

To maximize accuracy, this study should continue for as long as possible, and at least for 3-5 years.

Research team:

The magnitude and importance of this research require a team approach with close coordination and cooperation among university scientists, U.S. Forest Service entomologists and the Texas Forest Service. The team leader should be a recognized SPB expert, preferably a university scientist that is not prejudiced by affiliation with U.S. Forest Service, Texas Forest Service or private timber interests. Other team members should represent the U.S. Forest Service, Texas Forest Service and an environmentalist organization. Criteria for team selection must include objectivity, expertise and a willingness and determination to work cooperatively.

Funding requirements:

The preliminary nature of this proposal precludes calculation of an accurate budget. However, a cost of $200,000/year seems to be a reasonable estimate.

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Effect of direct control techniques on the Southern Pine Beetle in east Texas

Purpose: The purpose of this research is to:

(1) compare the impact of direct control techniques (i.e. salvage and cut-and-leave) and no control efforts on the population dynamics of SPB over relatively large areas;
(2) determine the efficacy of direct control methods on reducing the number, size, growth and proliferation of SPB spot infestations; and
(3) quantify the economics of timber losses associated with SPB direct control techniques and no control efforts.

General design: This research will utilize a paired comparison approach in which each of the 5 east Texas Wilderness areas is paired with a similar National Forest area. No SPB control measures will be used in the Wilderness areas and conventional control measures (especially salvage and cut-and-leave) will be utilized in the comparable National Forest areas. Periodic and systematic monitoring of SPB populations will be conducted in all areas to determine population density and distribution, spot growth and proliferation and timber losses.

Criteria for pairing areas: A paired comparison approach is most effective if paired areas are selected so as to maximize their similarity with respect to the most relevant characteristics. As many as possible of the following criteria should be considered and evaluated in the selection of paired areas.

Physical factors
Size (acreage)
Elevation
Soil characteristics
Moisture
Proximity

Forest factors
Species composition and relative abundance.
Age (size)
Vigor
Previous silvicultural practices

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TEXAS COMMITTEE ON NATURAL RESOURCES
4144 COCHRAN CHAPEL ROAD
DALLAS, TEXAS 75209
(214) 352-6370
March 23, 1986

Hon. John Seiberling, Chairman
Subcommittee on Public Lands
House Committee on Interior and Insular Affairs
House Office Building Annex
Washington, D.C. 20515

Attn: Kathy Saterson

Dear Mr. Seiberling:

In accordance with your allowance of time for me to submit a written statement after the hearing of March 18 on Southern Pine Beetles in Wilderness, Texas Committee on Natural Resources hereby urges congressional action to stop all buffer-cutting in wildernesses. Such buffer-cutting has failed to control the Southern pine beetle population or movement, and has failed to prevent the infestation of pine trees outside wilderness boundaries and in red-cockaded woodpecker colonies anywhere.

The Southern pine beetle is so widely dispersed that it will attack susceptible pine stands regardless of how many spots are buffer-cut. Buffer-cutting and log-hauling may actually contribute to the extent of an epidemic.

As a part of our statement, we attach:

1. Facts Belie Forest Service Testimony as to Four Notch.
2. Evidence Conflicts with Photo Testimony of Dr. Ronald Billings, plus exhibits.
3. Beetles Outside Four Notch.

Please include this statement and all attachments in the hearing record.

Cordially,

Ned

Edward C. Fritz, Chairman

ECF:edf

Encl. (3)

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TEXAS COMMITTEE ON NATURAL RESOURCES
4144 COCHRAN CHAPEL ROAD
DALLAS, TEXAS 75209
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March 23, 1986

FACTS REVEAL FOREST SERVICE TESTIMONY AS TO SPOT EXPANSION FROM
By Edward C. Fritz, Chairman

Contrary to the impression given by a Forest Service witness at the public lands subcommittee hearing on Southern pine beetles in wildernesses, the spots shown in his photographs originated outside the Four Notch Further Planning Area at about the same time in 1983 as the spots inside, and the outside spots skirted inside to merge with the inside spots, in spite of heavy buffer-cutting.

Evidence is presented below.

By showing a series of photographs which depicted only the SPB expansion well within the Four Notch, and following with a later photograph showing the merged infestation both inside and outside the east boundary, the witness made it appear that the enlarging spots inside had spread from inside to outside. That was not the case.

The witness indicated that the damage to pines outside the Four Notch resulted from delayed buffer-cutting. On the contrary, the spots outside were cut and removed while small (two were only about an acre or two when first cut), but, in spite of cutting, broke out westward into the Four Notch. Likewise, the main "head" of the biggest spot inside the Four Notch was westward, away from the east boundary at issue here.

The witness in question was Dr. Ronald N. Billings, Texas Forest Service chief entomologist.

The points of these discrepancies in the testimony are:

1. The Four Notch is not an arguable example (much less a scientific example) of an SPB spot spreading continuously (or by skips) from a wilderness-status area (or any area) over a considerable distance to pines outside that area. Rather, it is evidence that in an epidemic, SPB spots are widely scattered. SPB may infest a susceptible pine stand from any direction.

2. The Four Notch is not an arguable example (much less a scientifically proven example) of an individual SPB spot spreading to area-wide proportions because of restraint from buffer-cutting. Rather, it is a huge example of the failure of intensive buffer-cutting to protect pines outside wilderness. Pine outside pines were infested regardless of intensive buffer-cutting of small, as well as large spots, both inside and outside the Four Notch Further Planning Area.

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3. The Four Notch is an example of ruination of a wilderness-status area by buffer-cutting, in this case, mostly cut-and-remove ("salvage").

4. Testimony by a witness from the Forest Service was highly misleading and unscientific.

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TEXAS COMMITTEE ON NATURAL RESOURCES
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March 23, 1986

EVIDENCE CONFLICTS WITH PHOTO
TESTIMONY OF DR. RONALD BILLINGS

The following eleven items refute the testimony of Dr. Ronald Billings to the subcommittee on public lands, House Committee on Interior and Insular Affairs, March 18, 1986, in which Billings departed from his written statement to show slides purportedly depicting a spread of Southern pine beetles from inside the Four Notch Further Planning Area to outside Forest Service lands to the east.

1. Aerial photo by Dr. John R. Hilliard, entomologist, Sam Houston State University, August 31, 1983, showing (See Beetles Outside Four Notch, attached)

   a. Foreground. Two buffer-cut SPB spots on Forest Service land outside (toward viewer) eastern boundary of Four Notch Further Planning Area, Forest Road 206, running across middle of photo from juncture with road at left (Forest Road 200, running to bottom of photo) becomes that boundary near right side of photo.

   b. Beyond foreground, just west of FR 200 and 206. Buffer-cut SPB spots on left and right of photo, with recent clearcut between them. These spots are more recent than the above two. They are just outside southeast corner of Four Notch FPA.

   c. Background. Thick band of green pines in Four Notch extending across photo from side to side (roughly north to south). This band is at far side (west) of wide beetle cuts on west side of FR 206.

   d. Far background. Big infestation in Four Notch beyond thick band of green. This spot is separated from foregoing cuts. It is the one which Dr. Ronald E. Billings showed in his first three photos at the public lands subcommittee hearing March 18, 1986.

After Dr. Hilliard's photo, the Forest Service cut through the thick green band, after which Dr. Billings took another photo ("October, 1983") in approximately the same direction showing the outside spots.

Either by camera aiming or by cropping, Dr. Billings kept the closer spots out of his first three photos. He thereby left the impression that the big spot (d) had spread suddenly from deep within Four Notch eastward (toward bottom, in Hilliard's photo) outside the Four Notch boundary. On the contrary, the sequence was actually from outside the boundary westward toward the thick green band, as some experts can assume by the spot shapes and ages, and as the following additional evidence verifies.

Note that most of the logs have been removed from the cuts, indicating cut-and-remove.

2. Statement by TCONR July 13, 1983, that "Four Notch is completely surrounded by outside clearcuts."

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3. Invitation by TCONR to media on July 14, 1983, to visit two SPB buffer-cuts on Forest Service land already under way just outside the Four Notch (two dots near lower right margin of map). During that day, the Forest Service publicly admitted that a larger cut on Forest Service land on the west side of FR 200 about one-half mile southwesterly from those two spots, included, in addition to a standard sale, the cutting and removing of pines for the "control" of SPB. TCONR and Sierra showed this spot to the media.

4. Article in The Courier, of Conroe, Texas, July 17, 1983, including photograph of the cutting and removing operation taking place in the third spot in preceding paragraph, west of FR 200, just outside the Four Notch Further Planning Area. This article includes the Forest Service announcement of cutting a buffer strip 250 feet wide inside the Four Notch.

5. Letter in Huntsville Item August 28, 1983, by Dr. John R. Hilliard, Professor of entomology, Sam Houston State University, describing the devastation which buffer-cutting was inflicting on the Four Notch area.

6. Article in Houston Chronicle August 29, 1983, describing Forest Service plans to cut 500 more acres of buffer-strips to "control" SPB.

7. Events Show That Cutting Does Not Control the Southern Pine Beetle, February 22, 1985, by TCONR. This statement includes the facts that the buffer-cutting in Four Notch had exceeded 3000 acres and was still proceeding. Ultimately, about 4000 acres of the entire 5700-acre Four Notch area were cut, plus huge acreages outside the boundaries.

8. Notice of Solicitation, No. 98-13-84-40, dated 7-17-84, and page J-11 thereof, calling for bids for shearing some of the areas just outside the Four Notch boundary, shown in preceding photographs to have been cut.

9. Solicitation, No. 98-13-86-75, dated 11-22-85, and page J-7 thereof, calling for bids for mechanical and hand planting of pine seedlings in the same areas. These last two exhibits show the ultimate fate of the Four Notch buffer-cutting program--total clearcutting and pine raising, giving birth to a new crop of pines to be devastated by Southern pine beetles.

10. As a result of frequent prescribed burns and other hardwood reduction practices, the area of the foregoing spots contained almost 100% canopies of Loblolly and Shortleaf pines, plus several clearcuts planted to pine from 1968 to 1979. This area was a far greater risk for pine beetle infestation than any of the five designated East Texas wildernesses. The spread of SPB in this Four Notch area is not representative of what might happen in the wilderness areas.

11. Of possible causal significance is the fact that from April on, throughout the big SPB spread, a team of foresters and entomologists working with the Forest Service was hacking open the bark of virtually every green pine ahead of the main direction of expansion (northwest), in the process of inspecting for SPB before any fading. Whether this made the pines more susceptible to invasion, or less resistant, is for experts to determine.

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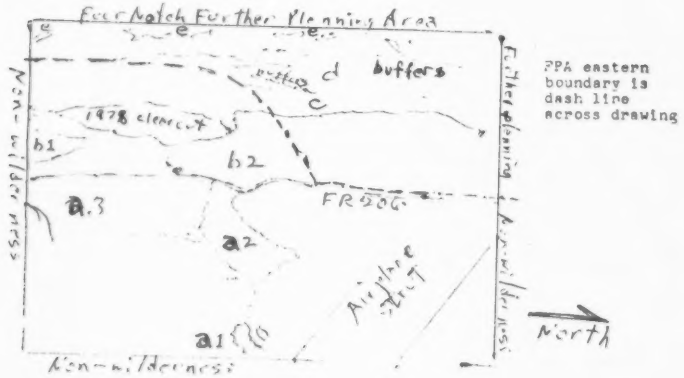
PEOPLES OUTSIDE FOUR NOTCH

Free-Hand Copy of Aerial Photo Taken 8/31/83 by Dr. John P. Willard Showing Locations of Infestations Outside (bottom 2/3 Photo) Four Notch Further Planning Area In Advance Of The Merger with Big Infestation Inside FPA (background)



Explanation

Begin with a at bottom of photo (foreground) and continue to e at top (far background)

a-b, Outside Four Notch FPA

a. Early SPB Spots. Reddish blotches (a1, a2, and a3) at bottom center and middle left originated before July 14, 1983. Note that the large pines in (a3) have been cut, leaving only dead pines standing above the smaller uncut trees. Crews had also cut east of photo.

b. Early SPB Cuts. In reddish areas (b1 and b2) at left and middle, crews cut large green pines in July, 1983. The pines which had died in June were left standing, as usual. Spot (b2) extends northward across the boundary into the FPA.

c-d, Inside Four Notch FPA

c. Band of Green Pines. This band plus other evidence debunks the Forest Service portrayal that the big SPB spot (d) expanded continuously eastward outside the FPA (a and b).

d. Big Spot. The reddish masses (d) in the far background comprise the only infestation, ever-expanding, which Dr. Ronald J. Williams showed in his first three photos (April-August). Then he showed an October photo which included for the first time the areas (a and b) outside the FPA, giving the impression that spot (d) had spread outside the FPA. He never explained that spots (a) and (b) had pre-existed outside his first three photos, expanding westward, and that in September they had merged with (d).

e. Private pastures surrounded by the FPA.

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TEXAS COMMITTEE ON NATURAL RESOURCES
5526 DYER, SUITE 111
DALLAS, TEXAS 75206
(214) 368-1791
February 22, 1985

Events Show That Cutting Does Not Control
the Southern Pine Beetle Population

A chronology of events demonstrates that the massive cutting program by the Forest Service inside and outside East Texas wildernesses has failed to prevent the situation that "tremendous populations of the beetles now exist all over southeast Texas."

Quotations of federal and state Forest Service officials, along with references to photographs, clearly evidence a tripling of Southern pine beetle infestations concurrently with expansions of the buffer-cutting program. Parenthetical notes are those of Texas Committee on Natural Resources.

Background: "SPB outbreaks tend to be cyclic, with populations typically increasing for three to eight years before subsiding.... (I)n 1976 a record 10,926 spots were detected." Texas Forests, March, 1984.

9/26/76: "...worst infestation in 75 years...And the cut-and-salvage control effort preferred by professional foresters is lagging far behind the rate of new infestations....some large spots have not been salvaged because wet ground prevents movement of the necessary equipment." Dallas Morning News. (Note: The Forest Service repeated this excuse when the beetles peaked again in 1983. See 9/10/83, below.)

1982: "In 1982, some 400 spots showed up...." Texas Forests, March, 1984.

7/3/83: "The Texas Forest Service...has already identified 86 beetle infestations in ...(8) counties." Huntsville Item.

7/8/83: "U.S. Forest Service Supervisor Mike Lannan has called for specific action to be taken toward controlling the outbreaks of the Southern Pine Beetle in two National Forest RARE II further planning areas. One of those designated is the Four Notch area.... Activities have begun in the Chambers Ferry area. The Forest Service currently plans to start felling operations sometime Monday on the cut-and-leave strips. In areas where the beetle control method will be salvage sales, preparation will begin on Monday, also, but it will be 10 and 20 days before sales can be made and actual operations are started." Huntsville Item.

7/10/83: "Three hundred acres in the 5,605-acre Four Notch area... and approximately 600 trees in the Chambers Ferry area...will be cleared, Forest Service officials say." Dallas Times Herald.

7/12/83: "...forest rangers are to start cutting down trees today in buffer zones around 35 beetle-infested areas in the proposed Four Notch Wilderness Area...." Houston Chronicle.

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7/15/83: "Delaying action until the beetles reach the boundaries of the Four Notch preserve, he said, would permit them to get well established for another major infestation next year of adjoining non-wilderness woodlands." Houston Post.

7/16/83: "The National Forest Service began cutting down trees this week in an attempt to stop the spread of the Southern Pine Beetle...." Bryan-College Station Eagle.

7/17/83: "The U.S. Forest Service has cut a swath 250 feet wide around an infested area trying to contain the pine-killing bugs." Conroe Courier.

7/15-20/83: Forest Service mailed notices of at least 28 salvage timber sales, bids to be opened July 22-27, and cutting to be completed in 30 days. Copies on file, Forest Service and TCONR.

7/21/83: "There is a very high probability the infestation will spread to [private or national forest managed stands] unless control measures are implemented immediately." Telegraphic message from Chief of Forest Service to TCONR refusing TCONR's request of July 9 for a stay of SPB cutting (a) until issuance of an environmental impact statement or (b) at least until the buffer cut be cut along the boundaries just outside of the wilderness instead of inside the wildernesses. (Note: SPB were already proliferating outside the wildernesses, near and far. See below.)

7/22/83 forward: Forest Service executed sales contracts on hundreds of beetle spots, eighteen of which were in the Four Notch. These contracts included about fifty percent "green" (uninfested) pine timber, constituting the buffers at the heads of the infestations. (FS cut TCONR off first for a period, but TCONR has about a hundred notices with details. Toward the end, most of the sales were without notice and without competitive bidding.)

7/29/83: Loggers had already cut huge SPB buffers in Four Notch. Photographed by Dr. John Hilliard in TCONR files, showing heavy equipment and dry ground condition.

8/16/83: "This EA and biological evaluations show that unless control measures are undertaken immediately, southern pine beetle infestations in the Turkey Hill, Big Slough, and Little Lake Creek RARE II recommended wilderness areas will likely spread to other public and private lands outside of these areas...." Decision Notice of Chief, Forest Service. (Note: SPB were already widespread.)

8/18/83: Hurricane Alicia entered and exited Texas. News item.

8/19/83: "If not controlled immediately, we fear the beetles will spread outward from these spots in the proposed wildernesses... the danger exists for environmental and economic damage outside the proposed wilderness areas if we stand by and let the beetles run their course'." Release, Forest Service Supervisor. (Note: No mention of Hurricane Alicia.)

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8/24/83: "On the Four Notch area alone, over 700 acres have been attacked and over 8,000 MBF of infested trees have been salvaged." Page 2 of Regional Forester's Responsive Statement to TCONR and Sierra Club Appeal. "The largest spot in the Four Notch area is now over 500 acres, and has, in fact, already moved into managed stands." Ibid p. 5. (Note: No mention of Hurricane Alicia.)

8/24/83: "Control measures are not expected to prevent new spot proliferations beyond the next spring. The purpose of control is to prevent the spread of large infestations (spots) into managed stands." Page 6 of Regional Forester's Responsive Statement to TCONR and Sierra Club. (Quaere: why damage wilderness areas to stop individual infestations if the SPB population, in general, is free to attack all parts of the forests from every other direction? See Conclusion, below.)

8/25/83: Loggers were highly active enlarging the Four Notch cutting. Photographs by Dr. John Hilliard in TCONR files. Dry ground.

8/29/83: "About one-tenth of the 5,600-acre Four Notch area, about 500 acres, is scheduled to be cut for buffer strips to separate the infested trees from the green, untouched trees, said Webb....the number of trees to be felled has increased as the beetles have spread." Houston Chronicle, p. 10, Sec. 1. (Note: No mention of Hurricane Alicia.)

9/10/83: "Southern pine beetles are ahead in the race.... By this week, that spot and the second largest spot had grown together and covered more than 1,000 acres of dead and dying trees.... Where Hurricane Alicia came into play, Miles said, was the hampering of the cut-and-salvage operations. The blow-downs across logging roads and the excess of muddy roads left by the hurricane rains have brought the salvage operations to a standstill in many areas." Huntsville Item. (Note: This is the first application in 1983 of the age-old excuse of wet weather. See 9/26/76, above. Actually, the Hurricane did not slow the cutting at Four Notch for even a week. See 8/25/83 et seq.)

9/10/83: "We estimate that it will take 45 to 60 days of satisfactory conditions to provide all the cutting that needs to be done." Huntsville Item.

9/ /83: Four Notch ground was dry. Cutting was proceeding. Photographs by Dr. John Hilliard, TCONR files.

10/6/83: "The primary objective of the suppression project is to prevent the infestation in Four Notch from causing economic damage on adjoining private land and managed National Forest timber. Current control strategies have not met this objective primarily because of the aggressiveness of this outbreak and excessive rainfall (over 30 inches) has prevented salvage operations from being completed. There are currently over 80 infested spots, including one over 1500 acres in size, in the Four Notch Area. The evaluation criteria is changed to allow treatment of all infested trees. It is necessary to treat all infested trees to curtail spot growth and proliferation. A new modified cut and leave method is to be initiated. This strategy

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may be used throughout the year on active spots of all sizes." Regional Forester's Amended Decision Notice. (Note: The only real change was to extend the July 6 program indefinitely. On July 6, the Regional Forester had stated that the program would end September 30, 1983, because, as pointed out in Forest Service Technical Bulletin 1613, cutting after September 30 of any year does not reduce the proliferation of SPB. That finding was posed by the Texas Supervisor on July 14, 1983, as a reason why he would not defer the cutting program until after preparing an EIS. Since the Forest Service had hastened, in July, August, and September, to cut without an EIS, on the excuse that cutting after September would be too late, it was anomalous for them to claim that they must cut after September because the earlier cutting did not produce the desired results.)

10/6/83: "Whether the normal rainfall for this area during the period of July-September is high or low is not important to this issue. The critical factor is that the ground was too wet to complete salvage removal of infested trees." Ibid. (Note: If the ground is repeatedly too wet for cutting to be carried out in time to succeed, it would seem that the Forest Service should not subject wilderness areas to the damages which result from such cutting.)

10/12/83: "Extremely wet weather hampered initial activities to control the beetle outbreak and caused infestation to reach epidemic proportions, so we brought in crews from Virginia, Kentucky, Arkansas, and New Mexico to hand cut a buffer strip ahead of the beetles, and we now have a containment line around the major infested area, Lannan said." Nacogdoches Sentinel.

10/ /83: The SPB had jumped the containment line. Forest Service photograph marked "October". File of Congressman Steve Bartlett.

10/21/83: "Lannan said the insect infestation, the worst in the history of Texas national forests, had been "reasonably well stopped" until about two weeks ago." Huntsville Morning News. (Note: The infestation was far from being stopped. The SPB had proliferated beyond all buffers.)

10/21/83: "According to the sale prospectus, the gross sale area is 5,700 acres but the actual sale area is slightly over 600 acres." Huntsville Morning News. (Note: The cutting ultimately covered more like 1,500 acres. See 6/27/84, below.)

10/22/83: "The ranger said there are still some bad 30- to 35-acre sized infestations which haven't been brought under control.... Webb said bidding will open Monday for the sale of the infested areas, but the cut trees will be required to be flown out by helicopter.... Part of our problem has been the rain." Huntsville Item.

10/22/83: Columbia Helicopter, Inc., is the only bidder for 6.9 million board feet at only $37.54 per thousand board feet.

10/25/83: "About 632 acres of southern pine beetle-infested pine trees in the Four Notch area near Huntsville were expected to be sold after bids were accepted Monday by the U.S. Forest Service said

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District Ranger Marq Webb...the contract will stipulate that the logging operation will be done by helicopter to minimize damage to the area.... Operations are expected to start in the next two weeks..." Huntsville Item.

10/26/83: Four Notch ground was dry. There were fresh truck tracks near piles of logs at loading area. Photographs by Brad Moore. TCONR files.

10/28/83: Four Notch ground was dry. Logs had been freshly cut. SPB were outside the cut areas. Photographs by Edward C. Fritz. TCONR files.

11/7/83: "Since it was so wet, the large spot could not be controlled by conventional salvage means. So to contain the rapid spread, a 250-foot wide buffer was cut around the infestation to contain further spread.... The buffer strip did prevent the individual infestations from continuing to grow at that rate of 400 feet a week. What has happened is some of the beetles have flown over the buffer and started up new spots outside the area because of the tremendous population there, what we call new spot proliferations. Many of these remain to be controlled. As a result, we are pushing for continued control to clean these up before next spring." Witness for Forest Service, which was opposing wilderness designation for Four Notch. Page 104, Hearings of the Subcommittee on Public Lands and National Parks, Committee on Interior and Insular Affairs, House of Representatives, Washington, D.C.

11/7/83: 'Although substantial progress has been achieved, it is critical that control operations continue uninterrupted throughout the fall and winter months...." Page 105, Ibid.

11/7/83: "It is now over 2,000 acres. Although the infestation has been largely contained, several scattered infestations remain to be controlled...." Page 106, Ibid.

11/7/83: "We are in the process of containing it. As I explained, we believe we contained the large infestation, the one that was moving at 400 feet along a 4-mile front. The beetle has jumped over in places...and the potential there is for disaste. 'f we don't clean those up before next spring." Pages 115-116, Ibid. (Quaere: What is "disaster", if not 2,000 acres destroyed? Answer: 4,000 acres. See 6/27/84, below.)

11/22/83: "A huge increase in the cutting program should not occur. The size of the cutting program will be entirely dependent on the magnitude of the infestations." Page 2, Regional Forester's Responsive Statement to TCONR/Sierra appeal.

11/22/83: "The major problem on the control project was that excessive rainfall seriously hampered logging equipment from completing salvage removal of infested trees from the outbreak area. However, even the spread of the large spot (1,500 acres) has been substantially retarded." Regional Officer's Responsive Statement to TCONR and Sierra's appeal of 10/6/83.

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March, 1984: "Some 1,400 multiple-tree infestations (spots) were reported in 1983, ranging in size from 10 trees to over 1,500 acres per spot. Despite sub-freezing temperatures that prevailed last December, prospects are favorable for even greater beetle activity in 1984, according to biological evaluations.... The largest population of SPB is believed to be concentrated in the Four Notch Area.... Over 2,000 acres of prime timber was killed by SPB in this unit, which until recently was being considered for wilderness. Since December, a helicopter has been used to salvage infested trees and reduce the huge beetle population in this area. By February, some six million board feet of timber had been salvaged by helicopter from the Four Notch Area. Yet, many new infestations have recently appeared and the salvage sale boundaries will need to be expanded if these infestations are to be controlled prior to spring.... If an infestation is detected, losses can be minimized with prompt application of salvage, cut-and-leave, or other recommended control method." Dr. Ronald F. Billings, Texas Forests. (Note: This is the second time they brought in crews, this time from six states. Yet the cutting still has not controlled the beetles. Their principal expert does not even claim control, now. All he says is, "losses can be minimized.")

6/22/84: "Following last summer's severe Southern Pine Beetle (SPB) infestation throughout east Texas forests, U.S. Forest Service Supervisor Mike Lannan says the National Forests in Texas is now facing the worst SPB infestation in its 50-year history. Tremendous populations of the beetle now exist all over Southeast Texas. According to Lannan, 714 SPB spots were found in the National Forests in Texas last summer, but roughly 1,250 spots have been sighted already this year with another month or two ahead before beetle activity should slow up.... This year, a record thirty-five million feet of timber has already been removed and sold by salvage sale from SPB infestations.... Forest Service crews from Kentucky, Virginia, Tennessee, Florida, Mississippi, and Louisiana plus contract crews are working to battle the beetle on the National Forests in Texas.... Lannan believes that the problem will continue and even intensify." Forest Service Release.

6/27/84: "Lannan said it is impossible to estimate the acres of trees lost in this summer's outbreak because there are so many small isolated spots. About 4,000 acres were lost in the Four Notch Area, a former proposed wilderness area near Wimberly." Bryan-College Station Eagle. (Note: 4,000 acres comprised nearly all the stands in the 5,600-acre Four Notch Area, other than young pine plantations and hardwood/pine stands along creeks.)

10/3/84: The 5,600-acre Four Notch and the 600-acre Briar Creek Extension are largely destroyed by SPB cutting. Photographs by George Russell, in TCONR's files.

10/3/84: Congress completes passage of East Texas Wilderness Act, HR 3788.

10/3/84: Environmentalists discover SPB cuts in Little Lake Creek Wilderness Area, up to 36 acres each.

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10/15/84: Forest Service sells one more SPB buffer in Little Lake Creek, cutting to be completed by November 15. Letter of December 7, 1984, from Texas Supervisor to Congressman John Bryant with details on 14 sales in Little Lake Creek, 13 of which were without notice and without competitive bidding.

10/22/84: "Throughout 1983 and 1984, the southern pine beetle epidemic continued on the National Forests in Texas. The infestation levels increased from 855 spots in 1983 to 2,710 in 1984, forest-wide. Insect activity in the wilderness areas also increased from 1983 to 1984 with 57 infestations occurring in 1983 and 89 occurring in 1984." Regional Forester's Notice of Decision to continue SPB cutting in five newly established wildernesses, to cut all spots of 30 trees or a potential to reach 30 trees (formerly 100), and to allow cutting of infestations as small as 10 trees (former minimum was 50 trees). (Note: The Forest Service is reacting like a "cutting surgeon" who, when confronted with the disastrous results of his masectomies, proceeds to make his operations even more radical, cutting to the bone.)

11/5/84: "Based on our past experience, we have found that control action is necessary under certain conditions to contain SPB infestations within the boundary of a land area. The Four Notch area, in the Sam Houston National Forest near Huntsville, is an example of what can happen when prompt control action is not taken." Forest Service Release announcing "plans for controlling southern pine beetle (SPB) infestations in five newly-established wilderness areas in the National Forests in Texas."

11/5/84: "In the Four Notch area during 1983-84 more than 3,000 acres of forest land was devastated by the tiny insect before the infestation was successfully stopped by U.S. Forest Service control actions." Ibid. (Note: The Forest Service desperately measures "success" in terms of cutting most of the grown pines. In other words, they would measure the curing of a disease by the deaths of most of the potential victims, even though others still are suffering and must be killed. See 12/21/84, below.)

11/5/84: "Had we let nature take its course and taken no control action, it is frightening to imagine how extensively the infestation would have spread to other lands outside the Four Notch area." Ibid. (Note: Bereft of any scientific basis for defending the holocaust of Four Notch, the Forest Service now resorts to sheer propaganda. They should explain why, in spite of heavy cutting, the SPB population outside the Four Notch was far worse in 1984 than in 1983, "all over southeast Texas", as admitted in their Release of 6/22/84, supra.)

12/21/84: "Clearly, many beetle-infested trees remain in scattered locations throughout the Four Notch area. Many of these infestations are larger now than the 1,500 acre infestation was at this time last winter. Under these circumstances, the U.S. Forest Service cannot afford to 'stop cutting at least until spring'." Letter from Ronald F. Billings, Texas Forest Service, to TCONR.

1/16/85: "Webb said the effort 'in some places is working, in other places is not'." Daily Press, Taylor, Texas.

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1/18/85: "Later, after things had calmed down, Charles Kelly Sigler, retired U.S. Forest Service ranger for the district including Little Lake Creek, conceded that tree-cutting had not stopped the beetle there, but said it usually succeeds. In a telephone interview after the dedication, Mike Lanman, U.S. Forest Service Supervisor for Texas, said 32 beetle infestations have been found in the new wilderness areas. Fifteen spots are under surveillance, trees were cut and left behind at 14, and they were cut and removed from three." Houston Chronicle. (Note: A year and a half and about 50 million board feet since the initial 3-month program of cutting in wilderness-protected areas, the Forest Service is still cutting in wildernesses.)

CONCLUSION

Although the Forest Service has been cutting buffers to "contain" Southern pine beetles for nineteen months, the beetles have not only held their own, but have almost tripled in infestations. Before the first year was over, the Forest Service had already sold 35 million board feet of pine lumber, not to mention the amount cut and left, nor the infested and dead trees never cut. On October 22, 1984, the Forest Service said, "Tremendous populations of SPB are now existing over all southeast Texas."

The only reasonable conclusion is that the cutting has failed to control the beetle population. In 1976, the Forest Service admitted that a similar cutting program had not succeeded. Both times the Forest Service gave excuses, including wet weather. But there is no example in history of humans controlling a beetle epidemic.

The Forest Service may argue that it did not expect to control the epidemic, but merely to prevent certain local infestations from spreading from wilderness to outside land. There are several answers, each of which is self-sustaining: (1) There is no proof that each particular infestation would have spread to outside land, if left alone, because the Forest Service did not document spreads from uncut infestations to outside lands; (2) As for spots just outside wildernesses, there is no proof that beetles did not jump the control buffers cut near wilderness boundaries; (3) The mere fact that some controlled spots did not spread does not mean that the control stopped the spread, because most uncontrolled spots subside on their own; (4) Since the beetles were so widespread, outside, as well as inside, wildernesses, there is no proof that any outside spot near a wilderness boundary would not have occurred even if nearby spots had been controlled.

The comprehensive axiom is that since SPB are widely scattered through the forests, and achieve cyclical peaks, even the successful stoppage of an individual spot by buffer-cutting does not provide any assurance that nearby pines will not be attacked by beetles from other spots. Unless a program controls the overall beetle population, there is no point in applying it within wildernesses.

Moreover, the Forest Service, in its predilection for cutting buffers in wildernesses to prevent spread to the outside (Release of November 5, 1984), ignores the fact that the beetles exist in greater density in national forest land outside than inside wildernesses. There were 2,710 infestations in the national forests in FY-1984 of which only 89 were in wilderness.

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On the basis of 600,000 acres of timberland in the national forests, of which 34,400 are wilderness, there was 1 spot per 216 acres outside wilderness, compared to only 1 spot per almost 400 acres inside. This is about 56% greater concentration of SPB outside than inside wildernesses!

The Supervisor's release also reflects increase of infestations from 855 in FY-83 to 2,710 in FY-84. Obviously, the heavy selling and cutting of buffers by the Forest Service in the Four Notch proposed wilderness and other areas failed to contain the SPB. They ruined the Four Notch to no avail. Yet they continue to cut up the new wildernesses under the claim of SPB control.

Even if cutting inside wildernesses were shown to prevent the spreading outside wildernesses, there are reasons why it should not be done. These reasons include, among others, (1) the relative values of losses to wildernesses, which are rare, and to commercial forest land, which is common, and (2) the preferability of cutting buffers immediately outside, instead of inside, wildernesses. But since cutting has not been shown to control the beetle population, but does inflict severe damage on the area cut, the reasonable conclusion is that cutting should not take place in wildernesses.

ADDENDUM

3/20/85 Letter from Texas Forest Service: In spite of widespread buffer-cutting, spots of 10 or more SPB-infested trees in Texas outside the four national forests increased from 650 in 1983 to 2760 in 1984, with prospects for a further increase in 1985, although 71 percent of the spots "received control action" in 1983 and 49 percent in 1984.

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TEXAS COMMITTEE ON NATURAL RESOURCES
4144 COCHRAN CHAPEL ROAD
DALLAS, TEXAS 75209
(214) 352-8370
July 13, 1983

WHY FOUR NOTCH SHOULD NOT BE CUT FOR BEETLES
By Edward C. Fritz, 4144 Cochran Chapel Rd. Dallas, 75209

The Cutting in Four Notch Wilderness planning area would damage that area and would not protect any timber outside Four Notch from Southern Pine Beetles (spb).

1. Cutting does not protect outside timber.
   a. Four Notch is completely surrounded by outside clearcuts which have few pines old enough to be threatened by spb. (The only exception is pine timber old enough to be harvested now.)
   b. If spb can fly across existing clear cuts to outside pine stands, they can fly over the widest buffer proposed or possible, so there is no point in cutting.
   c. There is no proof that cutting stops spb.

2. Cutting does damage to the area already cut.
   a. Heavy equipment and falling trees bruise and break the remaining hardwood trees, exposing them to fungus and disease.
   b. Cutting opens the area to too much sunlight for the growth of shade-loving species.
   c. Cutting operations require temporary roads, reducing wilderness value.
   d. Cutting leaves the area in an unsightly mess.

3. Spb do not harm the wilderness objectives.
   a. The goal is for Four Notch to return from pine management to natural hardwood, with fewer pines.
   b. The natural spread of spb inside Four Notch does not interfere with the return of a natural ecosystem.

4. Economically, cutting in Four Notch would cause more harm than good.
   a. Cutting would further glut the timber market, depressing prices and hurting the farmers.
   b. Cutting contractors would add few jobs. Even the entire Four Notch comprises only 1/20 of one percent of the timberland of East Texas.

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March 28, 1986

The Honorable Congressman Seiberling
Chairman, Subcommittee on Public Lands
812 House Office Bldg., Annex 1
Washington, D.C. 20515

Dear Congressman Seiberling:

The Society of American Foresters appreciates the opportunity to submit this statement for the record for the Oversight Hearing you held on March 18 regarding the U.S.D.A. Forest Service controlling Southern Pine Beetle infestations in federal wilderness areas. We would like to make three major points. Wilderness is a legitimate and important land use; forest lands designated as wilderness must be actively or passively managed in a technically and professionally sound manner to preserve their natural condition; and, in certain circumstances, the spread of insect infestations, diseases, and fires in wilderness areas should be controlled.

Wilderness is an Important Land Use

The Society of American Foresters recognizes wilderness as an important and legitimate use of forest lands. Forest Policies of the Society of American Foresters, comprising the Society's general statements on forest policy and approved by the membership, states:

> Forest conservation provides for maintaining some land in a wilderness state for spiritual enjoyment, scientific study, and primitive recreation.... Forestlands should be reserved and used for parks, monuments, recreation areas, wilderness areas, and natural areas where intensive study demonstrates that such reservation and use are in the long-term public interest.

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Management of Forest Wilderness

Forestlands designated as wilderness must be appropriately managed, either actively or passively, for that specific purpose. Depending on the circumstances, the method employed to manage for that purpose may vary from wilderness area to wilderness area. If not, they will likely lose some or all of their wilderness qualities through natural processes or man-caused misuse or overuse.

The goal of forest wilderness management should be to permit natural ecological processes to take place unmodified by man, to the extent feasible, while maintaining the wilderness quality and making available to human visitors a wilderness experience on a sustained basis.

Control of Insects, Disease, and Fire in Wilderness Areas

Control of insect infestations, diseases, and fire may be necessary to prevent unacceptable loss of the wilderness resource or to prevent damage to resources on adjacent public or private lands. Where this is the case, the methods of control used should not cause unacceptable alteration of the desired wilderness character of the unit as a whole.

The Society of American Foresters supports the control of insect infestations, such as the Southern Pine Beetle, in federal wilderness areas where:

1. There is a substantial threat of harm to the quality of the wilderness area, endangered species habitat, or adjacent lands if no action is taken;
2. An adequate environmental assessment has been prepared which fully discusses the alternative courses of action and their subsequent impacts on the wilderness area, endangered wildlife habitat, or adjacent lands;
3. The agency's analysis concludes that the public interest would be better served by the proposed course of action; and
4. There is a substantial likelihood that the proposed control method will succeed in that it is the best known management practice currently available for control of the insect infestation under existing constraints.

By meeting the aforementioned criteria, managing agencies would be held accountable, yet have the flexibility to manage wilderness areas in a manner consistent with the overall public interest.

.../...

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Section 4(d)(1) of the Wilderness Act of 1964 grants the Secretary of Agriculture authority to take such measures "as may be necessary in the control of fire, insects, and diseases, subject to such conditions as the Secretary deems desirable".

Some of the wilderness areas where the U.S.D.A. Forest Service is currently attempting to control the spread of the Southern Pine Beetle contain prime habitat for endangered species. Similarly, these areas provide many people with opportunities for solitude and primative, unconfined types of recreation. Insect infestations, diseases, and fires occurring in these relatively small wilderness areas often pose a significant threat to habitat, recreational opportunities, ecological and scientific values, and the numerous amenities of the areas. Control of these naturally occurring threats in the wilderness areas might well be in the overall public interest.

Outbreaks of insects, disease, and fire in small wilderness areas also pose a serious and often immediate threat to adjacent public and private lands. Adjacent landowners have frequently worked long and hard to establish their forests for both product and amenity values. Protection of their interests from threats originating on federal property should certainly be a major factor in determining the overall public interest.

We believe it is in the general public interest to allow the Forest Service and other managing agencies the necessary discretion to make fully informed and well-considered determinations of the best course of action to utilize in balancing the often competing interests of protecting the wilderness, the habitat of endangered species, values of the wilderness users, and the values of adjacent landowners. This is consistent with the intent of the law.

Forest ecosystems involve very complex relationships. Managing them effectively, responsibly, and in a timely manner for whatever public or private purpose(s), is a task best accomplished by those who are knowledgeable about these complex interrelationships, the specific case at hand, the management objectives of the owners (public and private), and who are qualified by their position, education, knowledge, and experience to make sound judgements.

Thank you for the opportunity to present our views. The Society is currently establishing a task force to further study the issue of wilderness management and will prepare a comprehensive report on the subject. You will be forwarded a copy once it is complete. We look forward to providing information to you on wilderness management and other forestry issues in the future, if and when we can be of such service.

.../...

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If you have any questions regarding this statement, please feel free to contact us.

Sincerely,

Ronald R. Christensen,
Executive Vice President

cc: Kathryn A. Satterson, Ph.D.

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